THE RECOVERY ROOM ~ *Immediate Postoperative Management*

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PREFACE

MANY OF US who had experience in front line hospitals in World War II have carried with us a memorable impression of the effectiveness with which therapy was administered in postoperative shock and resuscitation units. The outstanding characteristic of these units was the immediate availability of almost all medical and physical facilities necessary for the care of the sick and wounded, including personnel trained in the use of these facilities. There was no question that these units provided greatest efficiency of care and contributed materially to the over-all reduction of morbidity and mortality. Our interest in recovery rooms has stemmed from this experience.

Since then, we have participated in the organization of several recovery rooms and have been consulted in the development of a few others. The experience gained in these projects has been reported in a number of articles. The inadequacy of these articles in conveying all the information we have gathered has filled us with a sense of frustration, which has finally prevailed over our better judgment, impelling us to write this book.

We have tried to present the organization and functions of a recovery room in as concise and detailed a fashion as possible without necessarily being dogmatic. Basic principles are discussed in order to give meaning to specific instructions. Since the immediate postoperative care is an integral function of the recovery room, detailed postoperative orders for various types of operative procedures are given. Such has been accomplished with the help of outstanding authorities in the various specialties who have graciously and ungrudgingly contributed to this work. We have also utilized diagrammatic illustrations to demonstrate in detail how to employ various types of equipment for the proper care of the patients during the immediate postoperative phase.

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INTRODUCTION

In writing this book the authors have assembled all the important data relative to the planning and function of a recovery room, as well as the medical and surgical care of the patient during the immediate postoperative period, they have carried out these purposes exceedingly well

To appreciate the justification of a detailed discussion such as is contained in this volume it would be appropriate to review the functions of a recovery room, which vary somewhat depending upon circumstances As organized throughout the country, some recovery rooms close at 5 or 6 P.M , the patients being sent to their rooms or wards In other hospitals, patients who have had major operations remain all night in the unit, and, in fact, if their convalescence is complicated, may stay in the recovery room two or three days This difference in the length of time patients are kept in the recovery room confirms the fact that the functions are not standard In the hospitals where the patients' stay in the recovery room is limited to only a few hours, the purpose is to keep the patients in a place well equipped with personnel and materials needed in emergency care until they recover from the anesthetic It is probably conceded that the period of recovery from the anesthetic is more dangerous than any other of comparable length, because of the increased incidence of respiratory complications (primarily obstruction) and postoperative hemorrhage

Although the danger of hemorrhage and other complications, such as acute respiratory obstruction occurring before the patient regains consciousness, is minimal after the first six or eight hours postoperatively, numerous other complications may develop during the succeeding twenty-four hours Important among these is atelectasis, which to a great extent may be prevented by good nursing and medical care in the early postoperative period In patients who have had operations of unusual magnitude, meticulous observation and therapy will often prevent serious complica-

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contacts with the teaching programs of other specialists if he is to achieve maximum ability in this field A thorough review of the information contained in this volume will be profitable for all physicians It will also be of invaluable aid to all nurses actively engaged in the care of patients The editors and authors are to be congratulated for their splendid accomplishments

WARREN H COLE, M D

tions such as electrolyte imbalance and hypovolemia Therefore, it would appear justifiable to keep patients who have serious major operations in the recovery room for at least twenty-four hours Nurses in a recovery room rapidly become specialized, and their experience in the care of the acutely ill patient will without question minimize the incidence of postoperative complications To a great extent their efficiency is determined by the physical arrangements of the room and facilities For this reason, it is essential that personnel planning a recovery room seek advice and counsel early in the planning stage

There is now total agreement that a recovery room results in better care of the patient in the postoperative period than when the patient is sent back to his room or ward and treated there In fact, the improvement in care furnished by the recovery room has been so striking that the authors have implied that the function of a recovery room might be extended to that representing an intensive treatment center, offering treatment to any acutely ill patient needing more than average care

All specialties are represented in the twenty-one chapters contained in this book Many of these chapters may be considered classical in the fulfillment of the purpose for which they were written The first and last chapters, though not dealing primarily with the professional care of the patient, are examples of excellent presentation and should be read by all personnel contemplating the introduction of a recovery room in their hospital In fact, these chapters are so helpful to one planning a recovery room that they should be read early in the planning stage, furthermore, they will be of inestimable value for reference after the facility is functioning

Many of the chapters include certain preoperative data Offhand, this would appear superfluous, however, since postoperative care is so often directly related to preoperative care the inclusion of many features of the latter is indeed justified In some instances, the therapy of certain conditions of the acute type which might not be encountered in the average recovery room is discussed Again, inclusion of this material is likewise justified and desirable from the standpoint of completeness, because the techniques embrace a specialized type of care

This volume is the first of its type to be presented The vast amount of information contained within it makes it exceedingly valuable to all interns and surgeons in training, regardless of their specialty In fact, the young internist will find the material of tremendous value, not only because the chapter dealing with medical problems is unusually informative, but also because the volume contains so much information with which every physician should be familiar In general, medicine is progressing too rapidly toward specialization The trainee in one specialty must have more

contacts with the teaching programs of other specialists if he is to achieve maximum ability in this field A thorough review of the information contained in this volume will be profitable for all physicians It will also be of invaluable aid to all nurses actively engaged in the care of patients The editors and authors are to be congratulated for their splendid accomplishments

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Chapter 1

AN ADMINISTRATOR LOOKS AT INTENSIVE THERAPY

MANUEL J SEGALL, MAX S SADOVE, M D,
and JAMES H CROSS, M D

AN INTENSIVE THERAPY UNIT has been defined as a special physical and functional unit in a hospital where patients may be segregated for the purpose of receiving intensive care and treatment at minimal effort and with a minimal cost to both the patient and the hospital This unit is really a further development of the postoperative recovery room Because of the success that has been realized in the care of postoperative patients, other hospital services have become aware of the value of this specialized care Therefore, in the interest of progress in patient care, hospitals of today should make a critical analysis of their resources with an eye for improvement

ADVANTAGES OF AN INTENSIVE THERAPY UNIT

What are the specific advantages that are to be realized through the implementation of this service in the hospital? The primary reason for the development of this unit is the increased efficiency of care to be afforded all patients This type of unit is designed to serve the best interests of the hospital Progress in patient care begets progress in hospital administration, particularly in areas where both interests are served Other advantages directed towards and logically growing out of the primary advantage are listed as follows

1 A diminished mortality and morbidity for the entire hospital
2 Improved nursing care through a greater conservation and concentration of technical skills

3 A general qualitative and quantitative improvement in nursing care for less acutely ill patients
4 A more effective utilization of personnel, equipment and supplies
5 A psychological assurance to both the patient and his family that all measures humanly possible and known to medicine are being employed for their benefit and welfare

These advantages represent over-all benefits that accrue to both the hospital and the patient Here they are stated in general terms, yet they can be broken down into further specific benefits that will vary in degree from hospital to hospital Certainly, the problems of arrangement of physical facilities and provision of staffing patterns permit the maximum realization of specific advantages *Realistically, however, every administrator knows* that the ideal type of arrangement exists only on paper Yet, he will also admit that the above-listed advantages are tangible enough to permit him to consider them seriously and weigh them in terms of long- and short-run costs and benefits to be expected

AIMS AND OBJECTIVES

In all probability, the administrator will first consider "What are the aims and objectives of intensive therapy units?" and "Do these aims and objectives run concurrently with those of the hospital?" The aims and objectives of an intensive therapy unit may be discussed from four aspects the *patient*, the *physician*, the *nurse* and the *hospital*

From the standpoint of the patient, this unit offers maximum efficiency in the utilization of all that the hospital has to offer As the reader will determine through other chapters in this text, the patient receives special-duty nursing care 'round-the-clock at a minimal cost, plus uninterrupted efficiency Concurrently, he receives the benefit of team physician care Because of the immediate availability of equipment and personnel, this service results in the lowest morbidity and mortality rates in keeping with the high standards established by the Joint Commission on Accreditation of Hospitals

Physicians representing various medical and surgical specialties are assured that their patients will receive continuous skilled nursing care, and that there is available in the immediate vicinity of the patient all of the essential equipment and medications necessary for the diagnosis, treatment and care such as cannot be offered by other means As most physicians will agree, this becomes an increasingly important consideration in institutions where there is a relatively small load of rare and complicated cases Also, the physician may rest assured that there is trained personnel

on duty at all times of the day and night who will contact him immediately in the event of an emergency and will carry out his orders and required procedures completely.

The advantages accruing to the nursing service are quite similar to those resulting from group or team nursing. Professional training programs may be carried out in the intensive therapy unit on a postgraduate and/or undergraduate level without creating a disturbance to routine. The intensive therapy unit offers sufficient equipment, facilities and learning opportunities to provide excellent clinical experiences for both graduate and student nurses in the care and treatment of the seriously ill patient. In a unit of this type, there is an assurance that the skilled head nurse and her team are aware of the important problems of patient management, can anticipate complications, needs and desires of all concerned, and are fully qualified not only to carry out the procedures, but also to teach them to others.

Probably the most important benefits that an intensive therapy unit has to offer are that routine care on a typical nursing floor can be carried out with optimum efficiency, and that there is an equal distribution of care to all patients. The attainment of these objectives is not always possible in hospitals today. Since most hospital rates are designed to cover a given quantity of nursing care along with charges for room and board, the patient is entitled to this care. In too many instances, patients requiring more nursing care than presently received do not obtain it in the proper amounts, either from a medical or a financial standpoint. This inequitable distribution of nursing care on nursing floors frequently results in a higher morbidity ratio and longer length of patient stay than would exist under ideal conditions. The results are costly, both to the patient and to the hospital.

The intensive therapy unit's primary advantages accruing to the hospital are consistent with the aims and objectives of the hospital as a whole. Stated generally, such a set-up enables the hospital to provide the best type of service at the lowest possible cost to both the patient and the hospital. There is a trend in hospitals today toward securing the greatest value for each dollar spent. Because of many obvious reasons, hospitals of today are faced with a situation peculiar to the times. No longer are there the hospital "godfathers" who existed in the past, and every effort is being made to conserve. Methods improvement programs, now enjoying increasing popularity, stress the more effective utilization of personnel, supplies and equipment. Many problems growing out of these three categories are being solved through more intelligent planning and a more realistic approach. Hospitals are beginning to ask "why," instead of

only "when" as in the past Personnel are now being trained through work simplification training programs not only to question existing ways of performing service, but also to be creative enough to envision entirely new methods of operation This approach to problem-solving is now being harnessed and applied to ways and means of achieving a better utilization of personnel, supplies and equipment By shortening procedures, through labor-saving appliances, and the application of good common sense, much unnecessary waste of time and materials is now being curtailed By reducing great distances required to transport various hospital items, including personnel, services are becoming more streamlined and less costly to perform Therefore, time saved is made available for the performance of functions that better serve the best interests of both hospital and patient The concentration of equipment at the point of use is certainly an outgrowth of this type of thinking The concentration of skilled personnel is another means of assuring desired results The improvement of skill automatically promotes the intelligent use of supplies and equipment Hence, the aims and objectives of an intensive therapy unit, at least, are consistent with this objective approach to hospital administration, which is really in its infancy, but which has promise of continued growth

PLANNING THE INTENSIVE THERAPY UNIT

For best results, the intensive therapy unit should be planned as a joint effort of individuals who are responsible for the care of the patient or the provision of personnel, equipment and supplies Since it is impractical for all concerned to have a hand in the planning, nevertheless these persons should be kept informed of progress periodically and be afforded an opportunity to voice their opinions and suggestions Past experiences show that this results in a better quality of service to be provided The majority should be represented by individuals who have had many years' experience at the hospital, and who, in the minds of their colleagues, will be real contributors in this joint effort The hospital may deem it wise to select the chief of every hospital service expecting to admit patients to the unit Such a group is not usually cumbersome, and may have experienced some cooperative effort in the past Time and availability are considerations that should govern the selection of individuals to serve on the planning committee Other factors being equal, this group, along with a representative or representatives of the hospital administration, should comprise the planning group

This group should not fail to consider the wealth of information possessed by other individuals in the hospital, for example, the director of

nursing service, the nursing supervisors, the head nurse to be selected for the intensive therapy unit and others whose contributions would be valued This group is large enough to accomplish many related projects and function through supplementary subcommittees, if feasible Once plans are under way, other individuals may be called in as "consultants," representing still other hospital departments, who will have frequent contact with the intensive therapy unit Past experience has proved that this advice is invaluable

The hospital administrator should be the key individual responsible for administrative planning and coordination He may, and usually will, elect to delegate authority for the accomplishment of certain projects for which he is not recognized as a specialist It is certainly advisable because of the presence of a specialist and because of the administrator's already overburdened activities in the hospital and the community Moreover, it is the administrator's job to interpret medical considerations in terms of how they may be effected administratively Thus, he should elect to "farm out" sub-projects to one or more of his staff It should be borne in mind, however, that the final responsibility for administrative planning and decision-making cannot be delegated and remains with the administrator

One of the prime responsibilities of the administrator concerns the question of new construction or renovation of an existing area To build anew means an availability of funds for new construction which may or may not be obtainable The administrator should bear in mind that the intensive therapy unit need not be housed in a new addition or wing to be effective, and that it need not be elaborate to be functional Certainly, many recovery rooms have been fashioned from existing areas that are strategically located within the hospital building As the reader will determine, the quality of care afforded the patient depends largely upon the degree of assembly of good equipment and personnel in right amounts and is indirectly concerned with the newness of surroundings Actually, this feature is considered by many proponents as a point definitely in its favor

Another major consideration belonging to the administrator is the availability of the necessary equipment in both quantity and quality The basic determinations of equipment needed should be made by first taking the recommendations of the medical staff into consideration as to the types and quantities of required equipment Much of this equipment can be located on hand, although decentralized throughout the hospital By centralizing this equipment at one point, others are not being deprived of its use, for the need is also centralized at the same location If the need is no longer present in a particular area, the equipment is no longer needed in that area In planning the flow of work in the intensive therapy unit, it

may be discovered that procedures may be performed more efficiently by having more than one piece of the same equipment Additional purchases are then justifiable Here, the wise administrator summons his purchasing "consultant" and secures his advice on the selection of equipment

This type of relationship between administrator and purchasing "consultant" should exist with other "consultants" who are already available on the administrator's staff In all cases, findings can then be made available to the intensive therapy committee along with the recommendations of the administrator

FORMULATION OF POLICIES AND PRACTICES

When preliminary planning reaches the blueprint stage, thought and attention might then turn to policy formulation, another important function of the committee

There are many important considerations that must be made by the intensive therapy committee long before the unit is available to receive patients To insure continuity of thought and action, it is deemed advisable that these policy determinations be put on paper and made available for future use A few of the many policy determinations that should be made are as follows

1 Admission criteria and length-of-stay
2 Authority and policy for release or transfer of patients from the unit
3 Personnel policies
4 Patient-care costs and charges
5 Records and record-keeping
6 Visitors
7 Patient-care procedures
8 Other administrative considerations relating to care of equipment, use of supplies and physical facilities

These represent only a few of the many considerations of policy that must be established No doubt these and many others will arise in the minds of those responsible for planning the intensive therapy unit

The administrator will be wise to delegate authority to his staff for the recommendation of basic policies for which he will have ultimate responsibility Once again, he may call upon his "consultants" in the field of nursing service to assist him in planning intelligent policy that will meet the needs of all concerned and particularly the needs of the patient

ARRANGEMENT OF PHYSICAL FACILITIES

The individual plan for an intensive therapy unit in a hospital cannot be recommended Invariably, it will depend upon the hospital, its type, size and role in the community One important point must be remembered Flexibility is a "must" in planning such a unit Teaching hospitals, for example, will want to emphasize the teaching aspects in their units, particularly when there is a school of nursing in the hospital's picture, emergency and receiving hospitals of large metropolitan areas will probably emphasize their ability to care for the emergency patient, community general hospitals will want to emphasize the versatility of their organizations, and hospitals with a large census of children must take pediatric equipment and specialized care into consideration In other words, the organization of the intensive therapy unit should be based upon the needs of the individual hospital, and the number and type of beds allotted after a careful statistical study of the workload has been made Planning should always be based upon the size, the census and the needs of the individual hospital

In the largest hospitals, it may be desirable to make these units multiple, i e , pediatric patients separated from adult, medical patients separated from surgical, and other such divisions as may be deemed advisable by the intensive therapy committee, depending upon the workload of the hospital Horizontally constructed hospitals encounter problems involving time-distance factors, and may find the multiple-unit plan quite feasible However, it must be recognized that certain disadvantages may result from decentralization, e g , increased cost of operation, multiple staffs (which may defeat the purpose of the unit) and additional equipment Yet, if a hospital is of sufficient size to warrant decentralization, the same benefits already enumerated would accrue to the patient This decentralized plan is not recommended for the small or medium-sized hospital In the large or extra-large hospital, further specialization may even result in additional improvements in patient care

Ideally, the location of the intensive therapy unit within the hospital should be nearest the service which provides the greatest workload and away from heavy traffic areas It should be readily accessible to elevators in a multiple-story building and away from noisy or congested areas It should also be located as near as possible to the hospital's ancillary service facilities If the majority of patients in a particular hospital in need of intensive therapy are surgical patients, it would then be advisable to locate the intensive therapy area as close to the operating rooms as possible to facilitate patient transportation It is for this same reason that postoperative

may be discovered that procedures may be performed more efficiently by having more than one piece of the same equipment Additional purchases are then justifiable Here, the wise administrator summons his purchasing "consultant" and secures his advice on the selection of equipment

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Ideally, the location of the intensive therapy unit within the hospital should be nearest the service which provides the greatest workload and away from heavy traffic areas It should be readily accessible to elevators in a multiple-story building and away from noisy or congested areas It should also be located as near as possible to the hospital's ancillary service facilities If the majority of patients in a particular hospital in need of intensive therapy are surgical patients, it would then be advisable to locate the intensive therapy area as close to the operating rooms as possible to facilitate patient transportation It is for this same reason that postoperative

recovery rooms are located close to operating rooms The intensive therapy unit should also be located close to central service to facilitate the movement of supplies and that portion of equipment not stored in the immediate area (Fig 1) Another factor of location that should be taken into consideration is the proximity to the radiology department Because patients in need of intensive care are not physically able to be transported great distances for x-ray services, portable x-ray equipment must be

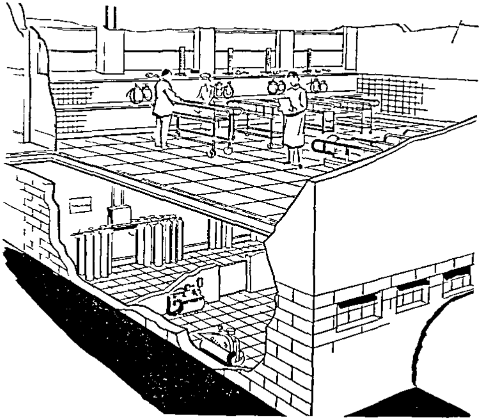


Fig 1 Cutaway view showing relation of central supply area to recovery room

transported to them To avoid excessive movement of this heavy and cumbersome equipment, consideration should be given to locating the unit as close to the radiology department as possible Various laboratory procedures will be required by patients undergoing intensive therapy, and many can be easily performed by providing a small laboratory within the unit itself However, the more complicated tests involving scientific equipment will have to be performed in the hospital's main laboratory For this reason, consideration should be afforded to a location near the laboratory Elevator service requires consideration in addition to that of patient transportation Because the type of patient to be given intensive care will be seriously ill, the unit itself should not be so situated that a physician cannot

reach it within a few minutes of the time of call Hence, the unit should be located as close to the main elevators as possible Traffic control and visitors are two closely related problems which should also be considered. If possible, some provision should be worked into the plans for a visitors' room adjacent to the intensive therapy unit Such a room might accommodate the minimum number of visitors, permitting them to view the patient without having to enter the unit proper, and insure against outside interference with the activities within the unit

It is realized by the authors that to satisfy all of these requirements a utopian situation would have to be created to provide for all needs This type of arrangement is not possible in the average hospital Therefore, the above considerations were enumerated as guides merely to be kept in mind when planning the intensive therapy unit in the hospital For those hospitals considering the renovation of an existing area, many of these considerations are out of the question The hospital in its formulative stages, and considering an intensive therapy unit, may be able to satisfy most of them through intelligent planning However, to do an effective job in the planning phases, all aspects must be considered and some compromise reached that will meet and satisfy the demands of the particular hospital

SIZE OF THE INTENSIVE THERAPY UNIT

The size of the intensive therapy unit will depend upon the maximum number of patients from all services that may need to be accommodated at any one time It can easily be determined by the number, type and length-of-stay of patients who are in critical stages of hospitalization The policies and practices pertaining to the use of the unit for all patients in need of this care, and the length of time that patients will be retained in the unit should also be taken into consideration when planning the size of the unit Planning committees should carefully study all facets of service to be offered. Since the patients to be treated in this unit will be those in whom this type of active concentrated care, in most instances, will result in recovery or at least a start on the road to recovery, it is difficult to appraise the number of such patients the hospital will have at any one time However, a careful study, whereby patients are classified according to the degree of illness, may provide a part of the answer as to how large the unit should be Continuing studies of a similar nature will provide an additional experience factor, so that averages will be compiled upon which future planning may be based

Generally speaking, in style and arrangement the intensive therapy

unit should resemble the postoperative recovery unit It should be so arranged that all patients may be constantly observed with little required effort Figures 2, 3, 4 and 5 show some of the different types of layout and arrangement

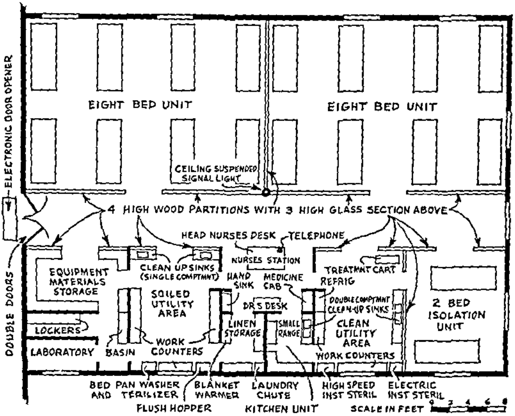


Fig 2 Suggested layout for an intensive therapy unit Each pair of beds is equipped with the following oxygen outlet (central oxygen system), suction outlet (central suction system), sphygmomanometer, bedside collapsible table (against wall), flexible wall lamp, small kitchen sink, heavy duty wall outlet for portable x ray unit, regular wall outlet, patient's individual call system (Sadove, Cross, Higgins and Segall The Modern Hospital, Vol 83)

Of particular significance is the layout diagram shown in Figure 3, depicting the work area in the center of the unit and beds classified for varying degrees of illness around the periphery This type of arrangement is ideal, for it provides for very little distance to be covered from central facilities to patient and return, or from patient to patient Observation of patients is also facilitated Other effective arrangements include the halved-room type, where the patient area is located in one-half of the room and central facilities in the other, as sketched in Figure 2 and as shown in Figure 4, where serious cases are segregated from minor cases Regardless of the type of arrangement preferred, several common features may be

universally applied Service facilities may be glassed in from all sides to permit steady observation of patients, the nurses' desk or station should be centrally located, and as much of the preparatory and clean up work shielded from patient areas as possible Each type of arrangement should also have an isolation area where patients may be segregated from others for a definite reason, i e , age, sex, infection, noise or the onset of extremis

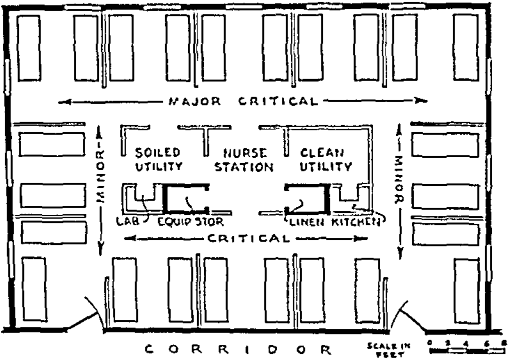
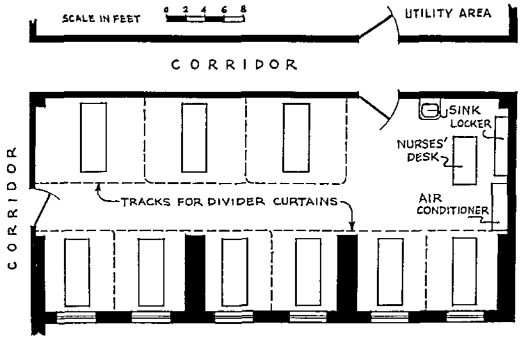


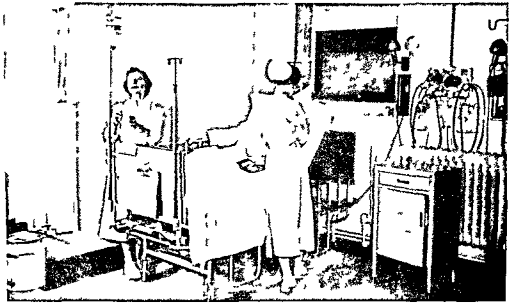
Fig 3 Alternative layout for intensive therapy unit, with work area in the center and beds for major and minor cases on either side and at ends (Sadove, Cross, Higgins and Segall The Modern Hospital, Vol 83)

Although every bed should have its own basic equipment, i e , oxygen and vacuum outlets, sphygmomanometer, bedside table, wall light on flexible metal hinge that can be removed for close patient examination, and the like, sufficient space should be allowed between each bed to accommodate any special equipment that may be needed Eight-foot bed centers are recommended

Service facilities should include a set of utility rooms for the receipt, storage and preparation of materials used in patient care, a small kitchen for the preparation of light nourishment for the recovering patient, sufficient space for the storage of needed equipment and supplies and a centrally located nurses' station where observations of the patients can be carried out concurrently with work performed, and will not be disturbing



A

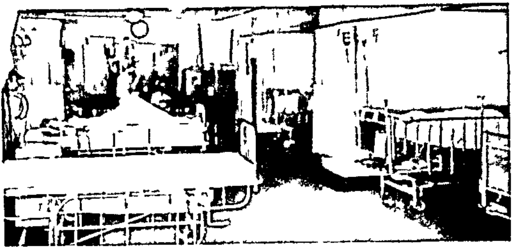


B

(C and legend on opposite page)

the revised need Those hospitals planning a new wing, or even a new building, may include a separate budgetary provision for intensive therapy unit equipment and supplies

A basic equipment and supply list for the intensive therapy unit might include tentatively the following items



C

Fig 5 Plan (A) and photographs (B, C) showing layout of intensive therapy unit at the University of Illinois Research and Educational Hospitals in Chicago Each of the three beds shown in upper portion and each pair of beds shown in lower portion of the plan (A) are equipped with four electric outlets, 110 VAC, O_2 outlet and Hansen connection, vacuum outlets, mercury blood pressure manometer attached to wall, bedside lamps and 8 foot extensions attachable to wall or bed (Sadove, Cross, Higgins and Segall The Modern Hospital, Vol 83)

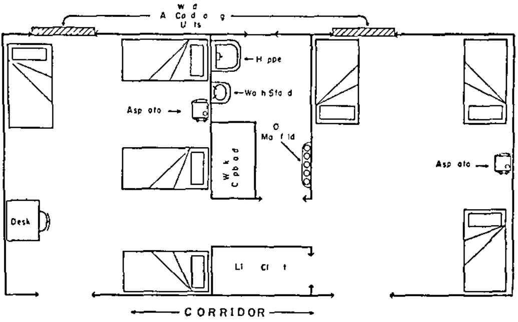
1 Individual oxygen and vacuum outlets to be located at the bedside These units may be either portable or fixed If they are fixed, a conservation of much-needed floor space will be realized (see Fig 1, p 8) The opportunity for fixation is much more likely to occur in new construction than in renovation However, portable equipment should be maintained close at hand in the event failure of the system occurs When an existing area is reconstructed, it may be difficult to install fixed equipment, and an all-portable oxygen and vacuum arrangement will have to be employed However, the use to which the equipment will be put and the advantages to be realized will certainly justify the slight inconveniences

2 Accessory oxygen equipment This includes oxygen tents, humidifiers, nebulizer units (see Fig 11), catheters, BLB masks, gauges and other related equipment

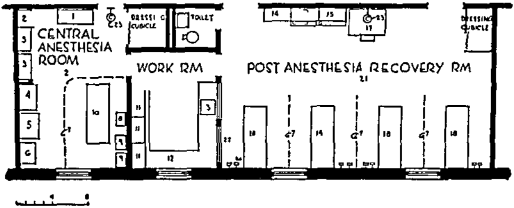
3 Accessory vacuum equipment—suction tubes and catheters, clamps, etc

4 Inhalation therapy and resuscitation equipment This equipment may be maintained in the intensive therapy unit or located nearby in the anesthesia department

5 A convenient and accessible refrigerator for the storage of biologicals, blood and other pharmaceutical preparations for immedi-



A



B

Fig 6 A, Diagram of postanesthesia observation unit in existing building

B, Diagram of postanesthesia observation unit when planned in a new structure

1 Supply table	12 Counter
2 Anes tray case	13 Sink
3 Case—glass doors	14 Linen case
4 Standing desk	15 Narcotic case
5 Resuscitator	16 Counter case with sink
6 Scrub sink	17 Nurses desk
7 Cubicle curtain	18 Postanes recovery cart
8 Portable aspirator	19 Centrally piped oxygen
9 Inst table	20 Centrally piped suction
10 Stretcher	21 Acoustic ceiling
11 Over-counter case	22 Observation window

23 Clock with sweep second hand

(Anderson Anesthesiology, Vol 12)

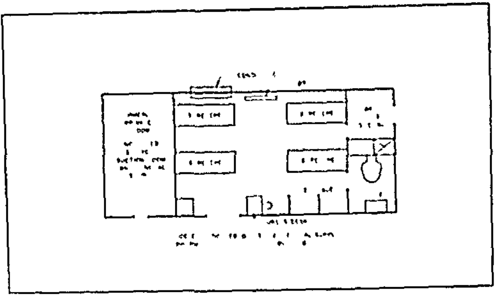


Fig 7 Four bed recovery room converted from four bed ward

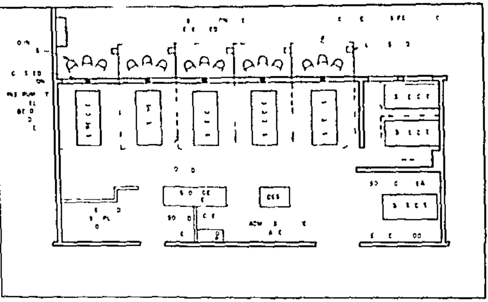


Fig 8 Recovery area for 200 bed hospital with visitors observation area

ate use This refrigerator should be located within the confines of the preparation area, i e , the clean utility room

6 Clinical sinks, hoppers and other fixed equipment for the rapid processing of apparatus and materials from a soiled condition to a safe, sterile condition for future use

7 A pressure sterilizer, to be located in the clean utility area, that will facilitate the sterilizing of small items of equipment and supplies prior to use This sterilizer need not be large nor must it be built-

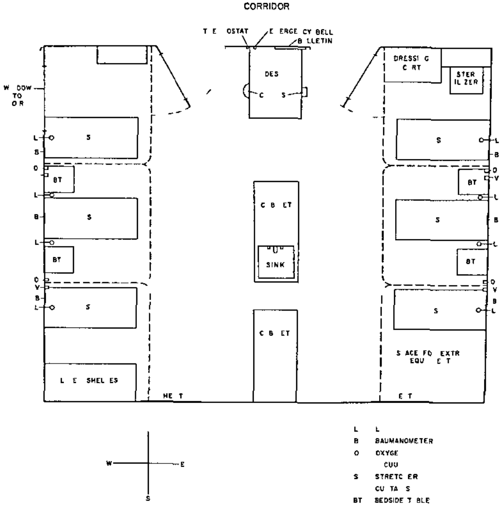


Fig 9 Plan of recovery room in the Community Memorial Hospital, La Grange, Illinois

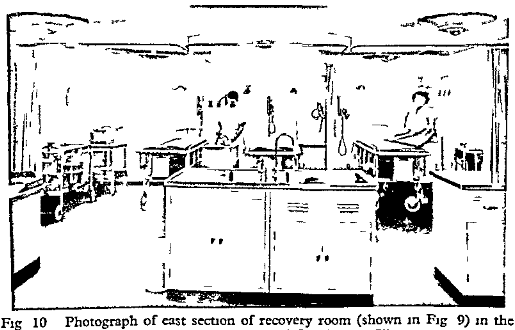


Fig 10 Photograph of east section of recovery room (shown in Fig 9) in the Community Memorial Hospital, La Grange, Illinois

in However, the amount of materials that flow through the intensive therapy area that need to be sterilized, along with the availability of sterilization in the near vicinity of the unit, should be the governing factor as to the size of the sterilizer If the decision is made that the intensive therapy unit should receive its supplies from central service, other sterilization needs may be met through the use of a table-top model high-speed pressure sterilizer

8 A built-in bedpan sterilizer Although this is not absolutely essential, it will be of great convenience to the nursing service per-

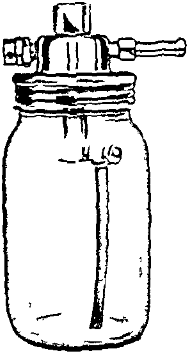


Fig 11 Ohio Aerosol Nebulizer Unit

sonnel of the unit It will provide for easy and rapid sterilization of bedpans, thus conserving the time and energy of highly skilled nursing personnel

9 A complete nurses' station, equipped with desk, chairs and an area that may be used by both physicians and nurses when charting is performed Other equipment for this area might include a medicine cabinet for routine medications, narcotics and other preparations, supply cabinet for forms and paper supplies, and lockers for nursing personnel The nurses' station should have a telephone that may be audible by a very low ring or buzz, coupled with a flashing red light above the door to indicate incoming calls If

this type of arrangement is not feasible, some other system accordant with the comfort of the patient should be installed

10 Each bed unit should possess the following basic equipment in addition to that which has already been mentioned

a Recovery-type bed (either the hi-low type with side rails, or the stretcher type), attachments for the erection of standards, and capable of being adjusted to any desired position, i e, Trendelenburg, reverse Trendelenburg, etc (Figs 12–17) The following reasons are offered for standardization of recovery room stretcher (1) most hospital beds are considerably wider than recovery room stretchers and are, therefore, more difficult to maneuver, (2) the adjustability of the recovery stretcher is far greater and, therefore, more flexible as to various positions, (3) the stretcher usually has built-in side guards which are easily adjusted, (4) casters on a stretcher should be 2-inch rubber, ball-bearing casters which are usually of the lock type Many makes of hospital beds are not equipped with lock-type casters —a common cause of embarrassing accidents, for example, in transportation, it frequently happens that smaller casters be-

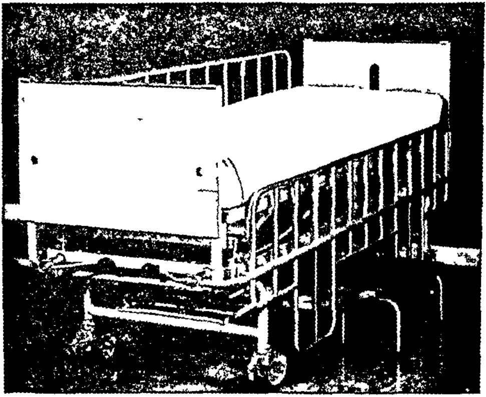


Fig 12

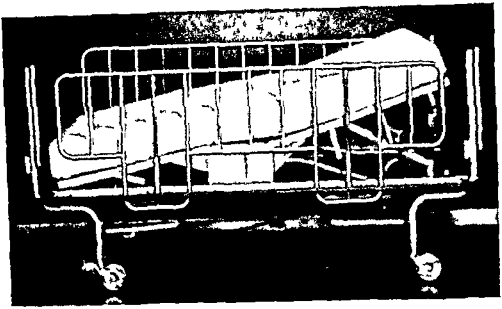


Fig 13

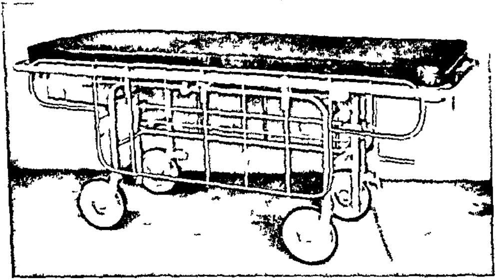


Fig 14

come caught between elevator cab floors and floors of the building

b Bedside table with separate compartments for bedpan, wash basin, emesis basin and all other equipment necessary for the individual care of the patient Some new recovery beds provide storage space for this type of equipment

c Wall-type or table-top-type sphygmomanometer to which blood pressure cuffs may be attached interchangeably This feature

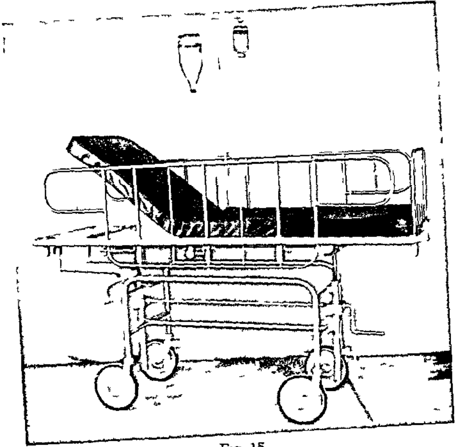


Fig 15

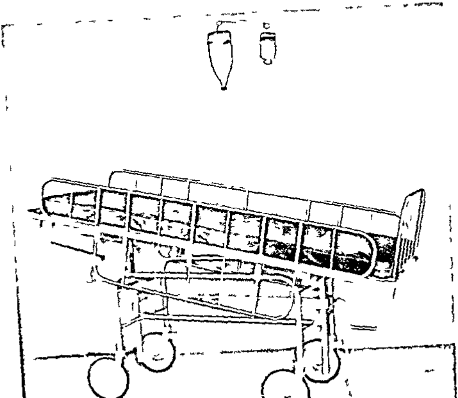


Fig 16

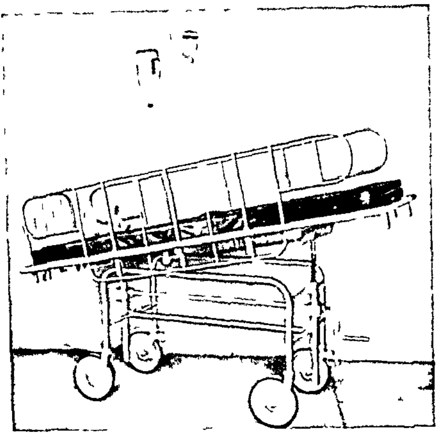


Fig 17

Figs 12–17 Recovery type and stretcher type beds

eliminates the necessity of moving one instrument from bed to bed

d Flexible-arm, wall-attached lamp that may be removed from the arm at will, for the convenience of physicians or nurses while examining patients

e Stainless steel or chrome alcove rods fastened to the ceiling with suspended curtains composed of a 4-foot wainscot of heavy, durable material, and the remaining part at eye-level composed of heavy polyethylene, transparent material This type of arrangement lends an aura of privacy and yet permits continuous observation

f Durable footstool that may be attached to the bed, and complete signal-call system for patient-nurse communication The terminal end of the call system might be set up on the center ceiling of the unit in the form of a four-sided light that may be observed from any location in the unit

g Sufficient electrical outlets on the wall near the head of the pa-

tient to provide for the use of any portable electrical equipment that may be needed, for example, a portable x-ray machine, electrocardiograph, basal metabolism machine

11 Other bed-accessory equipment, such as bed elevators and shock blocks, to be used for beds not equipped with built-in attachments

12 Treatment carts for the logical assembly of materials and supplies and the rapid transportation of these materials and supplies to the patient's bedside

13 Small range and icebox for the unit kitchen Other equipment may include a toaster, soft-boiled egg preparation equipment, trays, china and silverware (Caution must be advised against the overuse of this kitchen, from the standpoint of control of foodstuffs and cost of operation Any abuse of the uses for which this unit kitchen is intended will invariably result in an increased cost of food preparation Normal meals should be requisitioned from the central kitchen)

14 Ample work-counter space throughout the soiled and clean utility work areas One of the main errors of space-layout is the failure to provide sufficient space for the performance of work Too often, valuable working space is taken up with infrequently used equipment crowded together

15 Hand sinks located at strategic places throughout the unit Frequently, physicians and nursing personnel desire to wash their hands following examination and treatment of patients

16 Lavatory equipment

17 Treatment table and related equipment for treatment room to facilitate minor procedures This area may also be used for making electrocardiograms and basal metabolic rate determinations and performing other diagnostic procedures

18 Simple laboratory equipment for performing simple laboratory procedures, e g , urinalysis and complete blood count

19 A sufficient supply of bed linens for normal plus emergency needs, based upon patient census in the unit, to guard against rapid depletion of linen stocks It is also advisable to segregate intensive therapy linen from other linen by dyeing this linen a distinctive color

20 Blanket-warmer and solution-warmer Newer hospitals may have this equipment built-in to conserve space

21 Laundry chute direct to laundry

22 High-speed electrical instrument sterilizer to be located in the clean utility room

23 Ample storage space in stainless steel or chrome cabinets for necessary instruments, provided these instruments are not a part of instrument sets that may be requisitioned from central service
24 Double doors leading into the intensive therapy unit, easy-swinging with metal protective plates Some hospitals may elect to install doors that may be opened from either side electronically
25 Treatment trays and sets on hand in sufficient quantities to meet existing needs All sets should be returned to central service following use Rigid procedures should be established, outlining the preparation of patient charges
26 Both soda-acid and carbon dioxide-type fire extinguishers These should be located throughout the unit at strategic positions
27 A sufficient amount of housekeeping supplies to enable nursing service personnel to perform light housekeeping duties (It may be advisable not to permit housekeeping personnel into this area)
28 Enough office supplies, consisting of chart forms, pens, ink and the like, to facilitate the keeping of records and the preparation of reports by nursing personnel
29 A supply of basic chemicals and pharmaceuticals for emergency use Care, as usual, must be afforded to the handling of narcotics and barbiturates

On occasion, when isolation becomes necessary, it is best that the intensive therapy unit have some means whereby a critically ill patient may be transferred for special care under completely aseptic conditions Therefore, a room established within the unit for this purpose will pay big dividends when such a situation arises It may also be used as a special quiet room for disturbed patients or for patients who have entered into extremis Psychologically, many obvious advantages may be realized by this type of accommodation It may also be used as an alternate location for making electrocardiograms and basal metabolic rate determinations, and for carrying out other procedures A heavy-duty electrical outlet for portable x-ray apparatus should not be overlooked for this area

TEMPERATURE AND LIGHTING

Room temperature and relative humidity are important in the care of the patient, and their consideration must not be neglected in the intensive therapy unit They should be individually controlled from the unit itself, and, if possible, apart from the main heating control system of the hospital Room temperature should be maintained at a comfortable range with little variance to the extremes Because air-conditioning lowers humidity, it is

desirable, particularly in those areas of the country which bear the brunt of the extremes of heat and cold The room itself should have a northern exposure so as to avoid the direct rays of the sun throughout the year Care must be exercised to insure that patients brought to the intensive therapy unit from other hospital areas do not experience a rapid change in temperature

Lighting should be fairly uniform throughout the unit Because natural light does not spread itself uniformly throughout an area, it may be necessary to adopt some means of artificial lighting Experience has shown that the best type of artificial lighting for a unit of this type is indirect lighting It permits the examining physician or nurse to determine successfully the patient's true color—an important criterion A turn-down system is recommended so that over-all light intensity may be varied at will An emergency stand-by system of lighting should be seriously considered when planning the unit

Each bedside should possess a sufficient number of electrical outlets that may be used for both AC and DC equipment Wall spaces approximately every two or three beds should be available for the inclusion of heavy-duty electrical outlets for heavy-duty equipment These heavy-duty outlets are usually 20-ampere, three-wire polarized installations

FINANCING THE INTENSIVE THERAPY UNIT

Total expenditures for the intensive therapy unit may vary from an absolute minimum to the amount necessary for a most elaborate facility It is only natural that the cost of this unit be carefully scrutinized by the administrator and his board of directors If a long-range view is taken of this project, it is apparent that the cost to the hospital in only one fiscal period will be negligible In fact, it may be possible for the hospital to give better and more efficient service and care with an actual saving both to the hospital in man-hours and to the patient in a shorter length-of-stay

Equipment for the unit need not be expensive in order to achieve maximum efficiency Actually, it is the saving in existing units of equipment through greater utilization that aids in making an intensive therapy unit economically feasible With a little ingenuity on the part of administrative and professional personnel, equipment already available in the average hospital may be assembled in such a fashion as to lend itself to the purposes of an efficient intensive therapy unit

Patient-care costs in the intensive therapy unit are minimal when compared with the service rendered A patient in a unit of this type is receiving private-duty nursing plus all the skills available to him in the individual institution A thorough cost analysis of this unit will reveal that the addi-

tional expense involved to the hospital can be adequately covered through an intensive therapy fee, if this is so desired The individual cost to the patient will be relatively small when one considers the services which the patient receives The hospital can easily and simply amortize the cost of the unit over a period of years

ADMINISTRATION OF THE UNIT

The policies of the intensive therapy unit should be determined by the same intensive therapy committee that took part in the planning of the unit The committee in charge of planning efforts may wish to continue functioning for a certain period after the unit begins admitting patients If the medical staff of the hospital has a policy of rotating members' committee assignments, then additional members should be appointed to the committee to replace those whose terms have expired If appointments are made every other year, at least one year's membership will be maintained for purposes of continuity This committee should determine the policies and prevailing practices of the intensive therapy unit However, in order that the unit should function properly, a single responsible physician, serving on the committee, should be continuously in charge of the unit The following factors, though not in logical order, are only a few that should be considered in the selection of a responsible physician to carry out the administration of the unit time that can be devoted by the physician, the physician's availability, qualifications, training and interests

Each individual physician who has a patient or patients in the intensive therapy unit should be responsible for the care of his patient or patients He should be fully enlightened as to the policies and practices of the unit, to ascertain that the care of his patients will be compatible with the function of the unit as a whole Teamwork in the intensive therapy unit is vital

Administratively, the intensive therapy unit should be classed as a separate division of the department of nursing service, and under the overall supervision of the director of nursing service, with a capable head nurse in charge of the unit The head nurse should be administratively responsible to the director of nursing service and professionally responsible to the intensive therapy committee

ADMISSION, TRANSFER AND DISCHARGE OF PATIENTS

Patients should be received in the intensive therapy unit at any time of the day or night The length-of-stay of a patient in the unit should be

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record sheet Notation is made of the patient's name, room and bed number, and physician, his anesthetist, operation and anesthetic, if he is a surgical patient, and times of admission and discharge The following records are recommended for retention

1 Patient's intensive therapy sheet—which becomes a part of the patient's permanent record
2 Intensive therapy unit daily record sheet
3 Monthly report of intensive therapy activities—which gives briefly the total number of patients, minimum and maximum time in the unit, and the average patient-time in the unit for that period

PERSONNEL

No unit is considered to be adequate unless it is continuously and conscientiously staffed by adequately trained personnel Many existing postoperative recovery units would not qualify as adequate intensive therapy units because they contain only the physical factors, and have, unfortunately, for long periods of time, inadequately trained personnel from a professional standpoint At no time must this unit be without a nurse in constant attendance Nor must this unit be so situated that a physician cannot reach it within a few minutes of call Ideally, resident physicians may be assigned to the unit on a twenty-four-hour basis This may be broken into eight- or twelve-hour shifts This service would be similar to that of any other, and should be so organized that the house staff rotates through this unit as it would through the emergency room, the medical, surgical or any other service in the hospital Interns, as well as residents, may be assigned to the unit for training and supervision, in addition to performing routine duties Attendants, nurses' aides and practical nurses may render excellent service in a unit of this type However, it must be emphasized that the need for exceedingly skilled personnel of a very high caliber is greater here than that in almost any other part of the hospital When assigned to the unit, these employees must be continuously and carefully supervised Ideally, the employees in this unit should not be at the extremes of age because of the exacting and fatiguing nature of the work involved Personnel in a unit of this kind should be carefully screened in order to obtain a staff that will not experience a rapid turnover Stability and continuity are of paramount importance Graduate nurses should be assigned to this unit only at their request Compensation should be commensurate with the work done, the responsibility assumed and the skill and training of the individual Periodic physical examinations, including chest x-ray examination, should be required of all personnel assigned to the unit

determined by mutual agreement between the physician in charge of the unit and the patient's own private physician

On admission, the patient should be checked in by the intensive therapy physician who should accompany him to the unit He should make periodic checks on the patient during his rounds, and may be called for special observation at the discretion of the head nurse

The patient's physician will visit the patient as often as possible following admission The routine procedure performed on admission should be standardized when possible and include a check of

1 Airways—mechanical and natural.
2 Respiration—for character and quality
3 Color of skin
4 Pulse—for character and quality
5 Blood pressure
6 Capillary refill.
7 Condition of skin
8 State of reactivity
9 Retention catheters, drain tubes, gastric tubes, etc
10 Dressings, drains and drainage

When a patient is to be discharged from the intensive therapy unit to return to his own accommodations, he is checked to see that he has

1 Full orientation
2 Normal respiration
3 Suitable circulation
4 A stabilized blood pressure
5 No excessive bleeding, drainage or discharge
6 Adequate drainage from retention catheters, drain tubes, gastric tubes, etc
7 All medical information charted for floor nurses

He may then be transferred on the same hi-low bed he has occupied in the intensive therapy unit When he arrives at his own accommodations, he may be transferred to his own bed, or, if beds are standardized throughout the hospital, he may merely be moved, bed and all, into position while the other empty hi-low or standard bed is returned to the intensive therapy unit This method of transfer lessens confusion in the unit itself

Records and record-keeping should be streamlined in the intensive therapy unit, and only those records should be retained that are absolutely essential On admission, each patient should be logged in on the unit daily

record sheet. Notation is made of the patient's name, room and bed number, and physician, his anesthetist, operation and anesthetic, if he is a surgical patient, and times of admission and discharge The following records are recommended for retention

1 Patient's intensive therapy sheet—which becomes a part of the patient's permanent record
2 Intensive therapy unit daily record sheet
3 Monthly report of intensive therapy activities—which gives briefly the total number of patients, minimum and maximum time in the unit, and the average patient-time in the unit for that period

PERSONNEL

No unit is considered to be adequate unless it is continuously and conscientiously staffed by adequately trained personnel Many existing postoperative recovery units would not qualify as adequate intensive therapy units because they contain only the physical factors, and have, unfortunately, for long periods of time, inadequately trained personnel from a professional standpoint At no time must this unit be without a nurse in constant attendance Nor must this unit be so situated that a physician cannot reach it within a few minutes of call Ideally, resident physicians may be assigned to the unit on a twenty-four-hour basis This may be broken into eight- or twelve-hour shifts This service would be similar to that of any other, and should be so organized that the house staff rotates through this unit as it would through the emergency room, the medical, surgical or any other service in the hospital Interns, as well as residents, may be assigned to the unit for training and supervision, in addition to performing routine duties Attendants, nurses' aides and practical nurses may render excellent service in a unit of this type However, it must be emphasized that the need for exceedingly skilled personnel of a very high caliber is greater here than that in almost any other part of the hospital When assigned to the unit, these employees must be continuously and carefully supervised Ideally, the employees in this unit should not be at the extremes of age because of the exacting and fatiguing nature of the work involved Personnel in a unit of this kind should be carefully screened in order to obtain a staff that will not experience a rapid turnover Stability and continuity are of paramount importance Graduate nurses should be assigned to this unit only at their request Compensation should be commensurate with the work done, the responsibility assumed and the skill and training of the individual Periodic physical examinations, including chest x-ray examination, should be required of all personnel assigned to the unit

Past experience has shown that many graduate nurses are eager to work in a unit of this type because of the high caliber of work performed and the extreme ease and efficiency with which these units function The profound gratitude of those patients who have been treated in units of this type speaks for itself Graduate nurses must continuously be given refresher courses not only of the formal, but, more important, the informal type

TRAINING

In small hospitals the surgeons or anesthesiologists are in a better position, perhaps, to observe personally patients in the immediate postoperative period than are those in larger hospitals, where this becomes increasingly difficult For these larger hospitals, the postoperative recovery room is a solution, patients returning from the operating rooms are detained in the unit until consciousness is regained

These patients are cared for by nurses and sub-professional personnel who have been specially trained in postanesthetic management and who are supervised by a surgeon or anesthesiologist, usually a member designated by the intensive therapy committee to carry out all medical policies established by the committee The nurses are rigidly trained to perform many lifesaving, emergency measures, e g , maintaining airways and administering oxygen whenever necessary Other training which is provided in nurses' refresher courses includes taking and recording blood pressure and pulse rate and performing other important procedures vital to the recovery of the patient

NEED FOR REFRESHER IN SERVICE-TYPE TRAINING PROGRAMS

All personnel assigned to the unit are well trained in the care of the postoperative patient and in the care of equipment An in-service educational program may be planned and carried out for the graduate nurses and ancillary personnel, *as well as an educational program for the student* nurses

The main duties of the nurse assistants and male nurse aids are transporting the patients from the recovery room to their respective rooms, and keeping the unit in order When these assistants are not busy performing their main duties, however, they may be required to sit with restless patients and to assist the registered nurses in many procedures

Through the in-service educational programs, auxiliary workers are given a thorough orientation of the physical setup of the recovery room, they are taught the care of equipment, such as oxygen apparatus, catheters,

suction devices, and closed drainage tubing and bottles, and they learn sterile technique All too often, nurses return to work after an absence of several years, only to find that many of the methods and procedures relating to patient care that were practiced formerly have now become obsolete, and that, therefore, the in-service refresher-training program bridges a very significant gap in orientation to the nurses' work routines

By actual care of the comatose patient, personnel are taught how to turn and position patients, they learn how to care for the comatose patient, the patient who is vomiting, the application of suction, how to connect and disconnect urinary catheters and Levin tubes, to measure drainage, to assist with starting the injection of intravenous fluids, how to tell if fluids are infiltrating, and how to move patients from stretcher to bed when the patients are taken back to their rooms

The in-service educational program for new staff nurses and student nurses should include orientation to the physical setup of the recovery room and to recovery-room routine Other topics which may be included are appreciation of the partially and completely unconscious state of the patient, maintenance of the patient's airway, use and care of emergency equipment, recognition and treatment of shock, oxygen therapy, suctioning and positioning of unconscious patients, specific nursing care following various types of surgery, preoperative medications and anesthetic agents and their effects

Student nurses should spend at least one week of their two months' operating-room experience in the recovery room Also, several more days might well be spent in the postoperative recovery room attending pediatric patients, so that they may gain some experience in the immediate postoperative care of children

PUBLIC RELATIONS

One hospital decided to convert an existing four-bed ward that was strategically located to a four-bed recovery room In addition to the realization of prime savings in nursing time and the improvement of patient care (all this resulting from a total investment of $4500 00), other returns of an intangible nature exceeded expectations This hospital was the first in its area to establish this type of facility, and, therefore, it wanted to tell its story to the public

Always willing to cooperate, the local newspapers seized the opportunity to send reporters to the hospital to take photographs and write a story about this new concept of patient care A generous amount of space was provided for the story, and the response from the community was encouraging This publicity actually touched off a word-of-mouth "advertising campaign" that turned out to be an enormous asset to the hospital

Many letters and words of encouragement were passed to the hospital about the community's appreciation of this improved type of service that was now being provided for its loved ones Patients, themselves, expressed gratitude for the constant and supervised attention given them in the recovery room Since this improved concept of patient care has been provided, personalized nursing care has been the result—and much to the patient's liking

Another hospital, larger than the one just described, planned and built an addition, adjoining the surgical suite and providing new central-service facilities in addition to an increment of patient beds A postoperative recovery room was also constructed This hospital recognized the need for improved public relations, and it sincerely felt that *true* public relations "begin at home" in the hospital Therefore, in the plans for an eight-bed recovery unit, each bed separated from its neighbor by a glass partition, a visitors' observation area was included This observation area is elevated several feet above the level of the recovery room A small alcove, furnished with three lounge chairs and a night table and accommodating several members of a patient's family, adjoins each patient alcove, but is separated from the patient alcove by a glass partition

The response to this type of consideration to patient's families has also been great It has exceeded all expectations Visitors do appreciate the opportunity to be "with their loved ones" during times of crises Therefore, this hospital has not only met the patient's needs, but has gone a step further and provided for the patient's family's needs

The experiences of the two hospitals described represent only isolated instances of how postoperative recovery rooms may be used for public relations' purposes In the first hospital a small investment resulted in benefits to both the hospital and the community In the second a further step was made by providing for family needs Both hospitals represent ingenuity on the part of the planners to solve a problem not only satisfactorily, but also providing answers to some of the public relations' questions that have plagued hospitals for some time No doubt many other public relations' problems may be met in a similar manner

INTENSIVE THERAPY AREA—AN ADJUNCT TO PREVENTIVE MEDICINE

Many hospitals today are opening up their doors during week-end periods of low census for members of their community Patients for diagnostic study are usually admitted at the beginning of the week end, and, during their stay in the hospital, are afforded the full service of laboratory and x-ray facilities In a few hospitals, these patients are admitted directly

to the intensive therapy area for their week-end stay Since surgery schedules are light on week ends, and scheduled operations consist mostly of minor procedures, this leaves the postoperative recovery area free to accept patients for diagnostic work-ups In this way, beds in the hospital are not taken up unnecessarily and further use is made of an otherwise idle recovery room Again, too, diagnostic facilities are close at hand

Some hospitals have established package programs for busy executives who desire this type of service, but are only able to take advantage of the plan on week ends These programs consist of a routine number of laboratory tests and x-ray procedures, which, coupled with medical counsel, are made available to the executive for a fixed, all inclusive fee This concept of preventive medicine, really in its infancy, is enjoying increasing popularity

IMPORTANCE OF THE INTENSIVE THERAPY UNIT TO TO SHORT-STAY PATIENTS

Many dental, cystoscopic, fracture-manipulation and minor surgical procedures require the administration of an anesthetic for their successful performance Although these procedures are performed in dental units, cystoscopic rooms, fracture rooms and minor operating rooms on outpatients, the need still exists for postoperative care All too often, these patients return to their homes immediately following treatment or study Although they do not need hospitalization, they do need some type of care prior to their departure from the hospital In most instances, some general anesthetic has been administered, and to leave the patient "on his own" may well result in a certain element of danger

The present trend is to provide some area where these patients may be sent to recover from the effects of their procedures and the accompanying anesthetic In many hospitals, these patients are sent to the postoperative recovery unit where they may remain as long as necessary What better facilities exist to meet the needs of these outpatients than those offered by the postoperative recovery unit? Several hours' stay under constant observation may be all that is needed to ensure a condition safe enough for the patients to resume their normal routines under their own power This is another example of the value of intensive therapy units and how they may serve the needs of outpatients

RELATIONSHIPS WITH OTHER HOSPITAL DEPARTMENTS

In general, the relationships that will exist between the intensive therapy unit and other hospital departments will depend, for the most part, upon the type of supporting service these departments offer Professional

departments, e g , medicine, surgery, pediatrics and obstetrics, will, of course, provide patients in need of postoperative care, in danger because of an acute medical condition, or requiring constant observation

Ancillary professional service departments, such as x-ray and laboratory, will provide necessary diagnostic procedures to follow the condition of the patient placed in the intensive therapy area The work of other ancillary professional departments, such as physical therapy and occupational therapy, must await the patient's discharge from the intensive therapy area before it may begin

Administrative departments bearing important relationships to the intensive therapy unit are the accounting department and the admitting *department*

The relationship with the accounting department will be based upon the various financial records and information that must pass between this department and the intensive therapy unit The handling of patient charges for room and board, charges of ancillary professional service departments, charges for drug items and the like must all follow definite fixed procedures Definite policies must be established relating to charging patients for room and board while they are in the intensive therapy area Popular practice calls for patients to be charged a "room and board" fee for their stay in the intensive therapy area only after the first twenty-four hours

Frequent contact must be established between the admitting department and the intensive therapy unit At all times the admitting registrar must be aware of the number and classification of patients in the unit She must constantly be aware of the condition of each patient and the intensive therapy physician's idea as to the extent of the patient's stay in the unit She must, at all times, make certain that those patients who are about to return to a regular nursing unit have a location reserved for them

Chapter 2

PRINCIPLES OF RECOVERY ROOM MANAGEMENT

MAX S SADOVE, M D, and JAMES H CROSS, M D

GENERAL CARE

Although there may be many different types of patients cared for in the recovery room unit, certain general principles of care will apply to all patients The patient treated in this unit will receive maximum benefit from the concentration of equipment and skilled personnel There must be certain criteria for selection of the type of patient best suited for such intensive therapy After the decision has been made to treat the patient in this unit, correct transportation must be provided which will safeguard the patient while in transit A set of procedures must be employed which will facilitate reception of the patient The professional team must provide immediate and continuous care which depends upon the nurse receiving information concerning the patient's previous condition, with specific instructions for further care This should include a warning as to specific signs or symptoms which would indicated impending complications The physician must carefully evaluate the patient and remain in personal attendance until adequate treatment and a specific outline of therapy are initiated

Selection of Patient for Intensive Therapy Care

The intensive therapy unit is a further development of the recovery room The recovery room was evolved primarily for the surgical patient in answer to a need for adequate concentration of facilities and trained personnel for care of the patient until he had recovered from his anesthetic The patient remained in the recovery room until his general condition was such that he could be transferred to general duty nursing care This was a

decided improvement over the previous practice of returning a surgical patient to his room or ward where the nurse had to watch the unconscious patient as well as perform her other duties If an emergency developed during the surgical patient's return to consciousness, a catastrophe was likely to ensue because of lack of proper equipment and absence of trained personnel The shortage of nurses has made the situation even more precarious With advances in surgery and with the progress and development of anesthesiology, more detailed specific therapy for the postoperative patient has become routine The present realization of modern hospitals of the necessity of well-trained anesthesiologists capable of adequate supervision of these units has further emphasized the value of care of the intensive recovery room type

There has been a natural tendency for other medical specialists to give their patients this superior medical care which previously was available only to the immediate postoperative patient, e g , the patient suffering from poisoning and the acute cardiac patient The close cooperation of the surgeon and internist, as, for example, in the care of a patient having a massive gastrointestinal hemorrhage or a complicated medical disease requiring surgery, especially emphasized the desirability of extension of intensive therapy care to include other than the postoperative patient

It has become evident that for the good of the patient, as well as from an economic standpoint, all patients who require intensive therapy should be given advantages that can be realized in an intensive therapy center All postoperative patients, many acutely ill preoperative patients requiring intensive therapy, and any patient in an emergency state, whether of a medical, surgical, pediatric, or obstetrical nature, who will benefit by such treatment should utilize these services An excellent example is that of any unconscious patient requiring resuscitation, or one in coma or shock Patients with a terminal illness who can be adequately treated elsewhere should not be allowed to congest the center unless this segregation works to the advantage of the hospital and is not detrimental to the unit The type of patient treated should, in general, be the one in whom active, concentrated treatment will, in most instances, result in recovery or at least allow a maximum effort toward recovery and not the one who may be adequately cared for on a routine floor schedule

The patient should remain in the unit until the entire physician team feels that care elsewhere in the hospital will be adequate

Transportation of Patient to Intensive Therapy Unit

After the decision has been made that a specific patient should be in the intensive therapy unit, the transportation of the patient becomes im-

portant In certain instances the patient may be so critically ill that therapy should be instituted prior to the movement Certainly the patient should not be transported if this would place his life in jeopardy Following surgical procedures, it may be necessary for the patient to remain in the operating room until shock, respiratory obstruction or depression, or other serious states are remedied The same principle may apply to patients in a precarious condition admitted to the emergency room The danger of moving a patient, even short distances, may at times make removal unwarranted

When transportability is established, preparation for moving should be initiated Moving an unconscious patient is extremely hazardous, and continuous, uninterrupted observation is necessary Adequate measures should be taken to insure safety If shock or "compensated shock" is existent, an adequate method of securing intravenous infusion should be established that will endure the move This means that a large-caliber needle, well inserted, should be fixed in position by careful taping and splinting The blood pressure cuff should also be left in place or removed immediately before the patient is transported, a record of the blood pressure taken after the patient has been placed on the cart should be made The tracheobronchial tree in an unconscious patient must be protected by an adequate airway, a simple rubber airway or an endotracheal tube being employed Since vomiting and regurgitation are common in unconscious patients, especially in postoperative patients, these patients should *all* be placed in a lateral recumbent or "tonsil" position to allow gravity drainage of the secretions, unless an actual contraindication exists A pillow should be placed between the flexed legs Specially constructed wedged pillows of sponge rubber or similar material are ideal for maintaining the position of the back Thorough cleansing of the tracheobronchial tree and upper respiratory passage by aspiration must be accomplished prior to movement If hypoxia, shock, or similar condition is present, or if there is need for inhalation therapy, a functioning portable unit should accompany the patient to the recovery room

The cart used for the transportation should be so constructed that it can serve as a bed in the intensive therapy center (Such a cart is illustrated in Chapter 1) It must be of a type that will allow proper positioning, easy access to the patient for treatment and examination, and have facilities to allow for the simultaneous transport of drainage bottles as well as direct or indirect attachments for infusion equipment Drainage tubes must be fixed to prevent their being dislodged If ideal carts are not available, then the usual simple surgical carts, with simple improvised adjuncts as indicated, may be used Side rails or restraining devices must be in place on the cart

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adequacy may be lifesaving Since oxygen is a vital substance to the body and is continuously in demand, re-establishment of the mechanism whereby it gets into the blood stream may serve to revive both the circulatory and respiratory systems and, indeed, the entire body (see details of treatment of shock and maintenance of respiration in Chapter 3)

As soon as possible, an appropriate examination should be performed This should include not only the aforementioned specific examinations, but also an inspection of the chest, to ascertain if there is symmetrical and adequate expansion, as well as auscultation of the lungs, to make certain that both are properly aerating Examination of the heart should include a check of the position and tones, as well as of the pulse and blood pressure The abdomen should be palpated for any unusual signs, and the presence or absence of peristalsis should be noted by auscultation The body as a whole should be evaluated The position of the patient should be re-evaluated to insure optimum physiological rest and comfort The sheets and blankets used to cover the patient should be of light weight and of adequate texture to prevent chilling They should not be restrictive to either respiration or extremity movement A towel should be placed about the side of the face to absorb saliva or other discharges A bath towel should also be placed about the head if the skin is moist Blood or secretions on the covers, gown, or patient should be removed to establish hygiene as well as for esthetic reasons Bed rails should be placed in position as indicated During all of this re-examination, continuity of therapy must be maintained

Conference between Physician and Nurse

The nursing personnel must immediately become thoroughly acquainted with the patient The patient's history, previous therapy, present status and the treatment proposed should be outlined to the nurse Possible danger signals that would indicate impending complications should be discussed in order that prophylaxis will be instituted If the diagnosis is not established, the nurse should be informed of the possible diagnoses and the tests and procedures that are necessary to aid in its establishment A well-trained nurse will save many lives in an intensive therapy unit and this is especially true if she has been thoroughly acquainted with the patient and alerted as to possible complications Oral instructions should be given the nurse, but orders should be written in detail on the chart to avoid misunderstanding and for future reference The nurse should be made to feel that her duty is equally important as those of the other members of the team Experience with intensive therapy units will convince physicians of the nurse's importance in helping to avoid complications and in saving lives

Before movement actually begins, a final check of the circulatory and respiratory systems should be made, with a simultaneous last check on the functioning of the infusion and drainage bottles

The movement of any patient in shock should be done with the realization that such a movement may precipitate aggravation of the patient's condition If there is compensated shock, an abrupt change of position may cause the blood pressure to drop to alarming levels In the critically ill patient, all stages of the transportation should be carried out with continuous observation and therapy

Positioning on the transporting cart should be accomplished in such a manner as to maintain respiration and circulation If the patient breathes easier with the head of the bed elevated, this elevation should be maintained The extremities must not be free to dangle from the cart, since injury could occur from striking a door or other object Care must be taken to avoid pressure on any area that may result in injury A strap should be secured over the lower extremities to prevent the patient from rolling from the cart A sheet or loose blanket should be placed over the patient to prevent undue heating or chilling

The patient must be accompanied during the move by adequately trained personnel The presence of the anesthesiologist and surgeon or their assistants should be routine for postoperative surgical patients The personnel accompanying the patient, however, should not wear clothes soiled in the operating room The movement of other patients should be supervised by a physician if the patients are in the critical condition required for their removal to the intensive therapy unit Properly trained attendant personnel are also necessary for these patients

It should be emphasized that, during all phases of the transportation, careful check of the pulse and respirations with a continuity of treatment must be maintained

Reception of Patient

Upon arrival in the unit, immediate reappraisal of the patient's status must be made This should include check of pulse, blood pressure, respirations, color, dryness or moistness of the skin, adequacy of the airway, condition of any wound or dressings, infusions, drainage bottles, position of the patient and any other factor that is pertinent In patients other than postoperative ones in whom the diagnosis is not established, resuscitative measures, if indicated, should be instituted immediately followed by more definitive measures If the blood pressure reading and pulse rate are low in spite of the infusions, it may be necessary to use vasoconstrictors as emergency aids while more specific shock therapy is being initiated The patency of the tracheobronchial tree is vitally important and insuring its

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3 Nutrition
4 Control of pain
5 Care of wounds
6 Antibiotic therapy

The management of circulation, maintenance of respiration, and nutrition are discussed in Chapter 3

CONTROL OF PAIN

All surgical patients expect and fear the pain associated with surgery Actually, many operative procedures are attended by very little pain Various controlled studies have shown that even in those patients in whom the medical personnel expect pain to occur, as many as one-third can be relieved of their pain by a placebo and about one-third by mild analgesics, while only one-third require true opiates and opiods

Definition of Pain

What is pain? What is its physiology? Pain is an unpleasant sensation of a specific type, as is pressure, heat, vibration and the like Pain has a specific receptor and conduction system, a relay center and an interpretation area in the brain Even though there are specific receptors, pain may be caused by stimulation, of an excessive degree or duration, of almost any receptor Thus pressure, itching, mild irritation, or other factor, if present long enough, may cause pain even though if applied for a short period of time it would not be "painful" The same sensation (stimulus) in different individuals or in the same individual may be painful at times and not painful at others

Pain is a definite unpleasant sensation which is really the patient's evaluation of various stimuli, and the stimuli only produce pain after a threshold is reached This threshold varies, depending upon the duration and intensity of the stimulus and the state of the central nervous system, as well as upon the other stimuli that are flowing into the central nervous system The threshold should, however, be relatively fixed for a given individual but the reaction to the stimulus is markedly variable The pain stimulus "hurts" to different degrees in various individuals, depending upon many factors such as race, age, sex, time of day, state of mind, past experience, over-all irritability (especially of the central nervous system), fear and mental attitude The physician cannot know how much a specific stimulus produces hurt or pain It is interesting to note the difference in painful stimuli or reactivity caused by such a simple procedure as a hypodermic injection or intravenous infusion In the child, one may see actual torment

Initial Record of Patient

A written record of the patient should be immediately initiated In surgical patients there will be previous records Especially important is the anesthesia chart which presents in concise detail the condition which existed during the operative procedure, including the type and amount of fluids and medications that were administered The recovery room record should be a somewhat similar chart which will give a visual presentation of the continuity of treatment and the patient's status Charting of the pulse, blood pressure, respirations, temperature, medications and fluids must be accomplished in such a manner that an instantaneous review is always readily possible (see Chapter 21)

The nurse should summarize the doctor's review of the case and her instructions A statement as to her impression of the patient's condition should be recorded The nurse's record should be continuous, so that her relief can easily understand what has previously transpired and what to expect

The patient's physican should, after initiating treatment and after re-examination of the patient, likewise give a detailed summary of the previous therapy and diagnostic tests performed as well as a statement as to the probable course This should be adequately detailed Ideally a summary of the previous history, physical examination and laboratory findings will be included, but such completeness at times may not be practical and a compromise with this ideal may be necessary In all instances, the record must be sufficiently inclusive to enable other doctors to maintain the continuity of treatment and diagnostic studies without disadvantage to the patient If there are medical complications coexistent with a surgical procedure, an outline of medication for these conditions should be included in the record, especially if such medication is vital to the patient, as in cardiac, diabetic, or similar diseases If there have been prior complications that might be prone to recur, such information should be in the record Previous significant diagnostic procedures should be available, both to prevent repetition and to aid in further therapy

In every patient's record there should be a statement as to whether there has been prior sustained use of cortisone or similar drugs Previous drug sensitivity should also be noted

Careful and explicit written orders must be recorded before the physician leaves the patient It should be emphasized that the patient is not to be left in the nurse's care until a continuity of treatment is established and the nurse is fully cognizant of the written orders and their implications In these written orders the following factors must be considered

1 Management of circulation
2 Maintenance of respiration

DRUG THERAPY FOR RELIEF OF PAIN

The drugs of value for relief of cutaneous or integumental pain are

1 Salicylates (aspirin)

2 Para-aminophenols
 Acetanilid (Antifebrin)
 Acetophenetidin (Phenacetin)

These drugs used alone, or in combination with codeine when pain is a little more severe, are safe, effective means of combating a large percentage of the musculoskeletal pain Side reactions are relatively rare and the efficiency is good A typical prescription would be

Acetylsalicylic acid	10 grains (0 6 gm)
Codeine sulfate	1 grain (0 06 gm)
or	
Acetophenetidin	5 grains (0 3 gm)
Codeine sulfate	1 grain (0 06 gm)
Give 1 capsule for relief of pain	

Either of these mixtures may be combined with various sedatives, such as the barbiturates, giving the total effect of benefit to the patient

The treatment of the visceral type of pain requires the use of more potent analgesics A following table lists some of the more important drugs and their dosages

Analgesics

		MORPHINE	DEMEROL	METHADONE	NISENTIL	LEVO-DRO-MORAN	CODEINE	DILAUDID	METOPON
Equivalent subcutaneous doses (mg)		10	100 I M	10	40	2	65	2	3
Maximum percent increase in pain threshold		90	60	100	100	100	50	100	100
Duration of analgesia		+++	++	+++	+	++++	++	++	++
Sedation		+++	++	+	+	+++	+	++	++
Routes of administration	Oral	+	+	++	++	++	+	+	+++
	Subcutaneous	++	No	Caution	++	++	++	++	Not available for parenteral use
	I M	++	++	Caution	++	++	—	++	
	I V	++	++	Caution	++	++	—	++	
Factors difficult to quantitate	Altering reaction to pain	+	?	?	?	+	?	+	?
	Sense of well being	+	?	?	?	+	?	?	?
	Euphoria	+	?	?	?	?	?	?	?
	Variability among patients	+	+	+	+	+	+	+	+

Common to all Nausea emesis respiratory depression tolerance addiction etc
Modified from Gross E G and Schiffrin M J Clinical Analgetics Charles C Thomas Publisher

at the mere sight of a needle, with the child screaming and fighting, or the child may make a slight grimace and promptly forget the entire matter In the adult, the same varied reactions occur In members of some races there may be crying and extreme reaction, while in others there may be only a flicker of a few muscle groups

Attitude of Surgical Team toward Pain

In the same patient who tolerated the "needle" initially, with the passage of time it becomes more painful If the patient likes the nurse, he may say it "hurts a little", if he doesn't like her attitude or brashness, he may say, "Ye Gads, she's killing me with the needles" The brain or mental attitude is the interpreter of the stimulus and the "controller" of the reaction Therefore, in dealing with pain in postoperative patients, one must always be aware of the fact that the surgical team does not know how much pain the patient has at any time Those treating pain must be aware of the importance of the mental attitude of the patient The little things one does and what one says are very important

The physician should show real concern about the patient's welfare He should reassure the patient and must not show irritation or seem to be in a hurry The patient should be made to feel that he is the most important problem on the team's mind and that the answer to the problem is definitely known He should be made to feel that, no matter what happens, this team will see to it that all goes well This attitude should be shared by every member of the surgical team, including the orderly

It is easy for the staff to acquire a tolerance for pain in recovery room patients and to become intolerant of the patient who becomes excessively demonstrative It is surprising what a little "verbal analgesia" can accomplish A minute spent in concern, interest and assurance, combined with or without a placebo, markedly diminishes pain

The keynote to good care is continuous interest, concern, calmness and assurance, combined with skillful use of all of the physical and chemical agents to relieve pain to the maximum degree consistent with the safety and future well-being of the patient

CLASSIFICATION OF PAIN

1 Cutaneous or integumental
   Bright—sharp—easily localized—definitely radiating
   Reaction fight or flight

2 Visceral
   Deep—burning—aching—difficult to localize—referred
   Reaction anxiety—anorexia—vomiting

DRUG THERAPY FOR RELIEF OF PAIN

The drugs of value for relief of cutaneous or integumental pain are

1 Salicylates (aspirin)
2 Para-aminophenols
   Acetanilid (Antifebrin)
   Acetophenetidin (Phenacetin)

These drugs used alone, or in combination with codeine when pain is a little more severe, are safe, effective means of combating a large percentage of the musculoskeletal pain Side reactions are relatively rare and the efficiency is good A typical prescription would be

Acetylsalicylic acid	10 grains (0 6 gm)
Codeine sulfate	1 grain (0 06 gm)
or	
Acetophenetidin	5 grains (0 3 gm)
Codeine sulfate	1 grain (0 06 gm)
Give 1 capsule for relief of pain	

Either of these mixtures may be combined with various sedatives, such as the barbiturates, giving the total effect of benefit to the patient

The treatment of the visceral type of pain requires the use of more potent analgesics A following table lists some of the more important drugs and their dosages

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Duration of analgesia		+++	++	+++	+	++++	++	++	++
Sedation		+++	++	+	+	+++	+	++	++
Routes of administration	Oral	+	+	++	++	++	+	+	+++
	Subcutaneous	++	No	Caution	++	++	++	++	Not available for parenteral use
	I M	++	++	Caution	++	++	—	++	
	I V	++	++	Caution	++	++	—	++	
Factors difficult to quantitate	Altering reaction to pain	+	?	?	?	+	?	+	?
	Sense of well being	+	?	?	?	+	?	?	?
	Euphoria	+	?	?	?	?	?	?	?
	Variability among patients	+	+	+	+	+	+	+	+

Common to all Nausea emesis respiratory depression tolerance addiction etc
Modified from Gross E G and Schiffrin M J Clinical Analgetics Charles C Thomas Publisher

A brief description of the characteristics of these drugs may be of aid to the physician

Morphine

This is a potent analgesic Its action is poor when given orally and best when given subcutaneously When indicated it can be given intravenously Sixty to ninety minutes are required for the peak action when it is administered subcutaneously, the onset of analgesia is smooth and there is less side action than when it is given intravenously Approximately fifteen to twenty minutes are required for the peak action when the intravenous route is employed The dosage is 10 to 15 mg This gives an increase in analgesic threshold of 50 to 70 per cent, 30 mg, a dose which should rarely be used, gives an increase to about 90 per cent With the 30-mg dose the

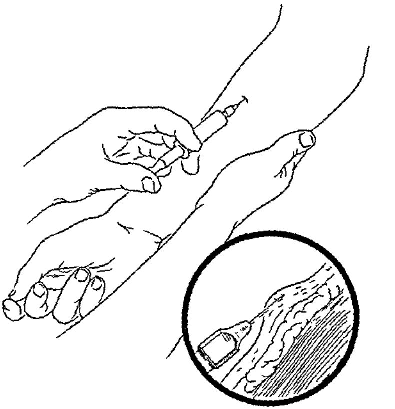


Fig 1 Intradermal injection on flexor surface of forearm

1 Use short, very fine needle (25- or 26 gauge) and tuberculin syringe Load syringe and expel air bubbles

2 *Cleanse area with suitable antiseptic*

3 Keeping needle almost parallel to skin, insert as superficially as possible and inject material

4 If needle point is in corium or true skin, injection will raise small wheal

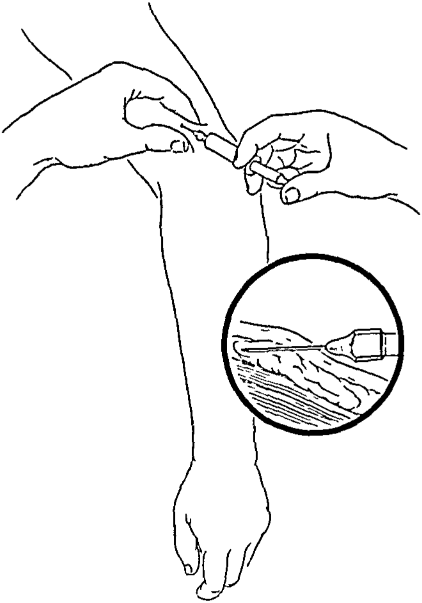


Fig 2 Subcutaneous injection on extensor surface of upper arm, this also can be made on the back or the lateral aspect of the thigh

1 Use 1/2- to 1 inch needle, 22 gauge or smaller, and 2-, 3-, or 5-cc syringe Load syringe and expel air bubbles

2 Cleanse area with suitable antiseptic

3 Pinch fold of skin between thumb and forefinger and insert needle quickly and firmly through all layers of skin

4 Pull back gently on plunger to make certain needle has not entered vein

5 If no blood appears, inject material slowly Up to 3 cc of fluid can be administered readily if needle point is in subcutaneous tissue and not in skin or muscle

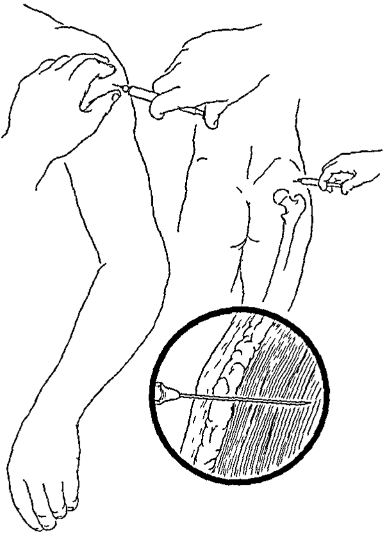


Fig 3 Intramuscular injection in deltoid or triceps muscle of upper arm, and upper lateral quadrant of buttocks

1 Use 1 1/2 inch needle, 19 gauge or smaller, and 2-, 3- or 5 cc syringe Load syringe and expel air bubbles

2 Cleanse area with suitable antiseptic

3 Holding syringe at right angles to body, thrust needle quickly through skin and into muscle tissue

4 Pull back gently on plunger to make certain needle has not penetrated vein

5 If no blood is aspirated, proceed with injection

6 Massage site gently after injection to hasten absorption

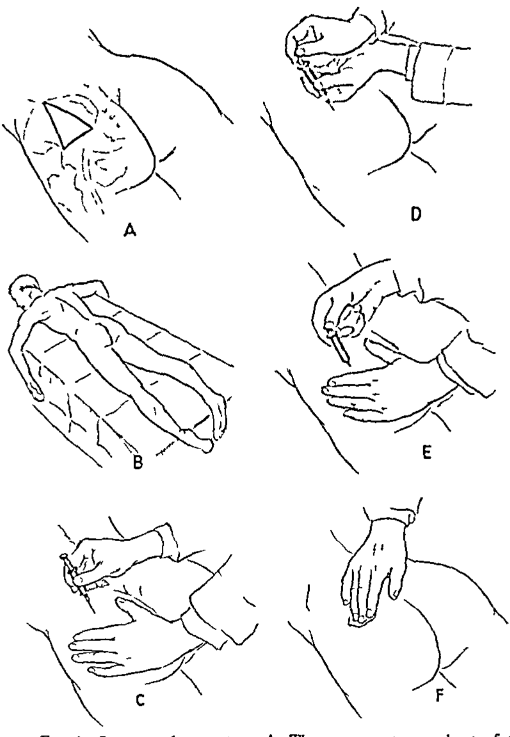
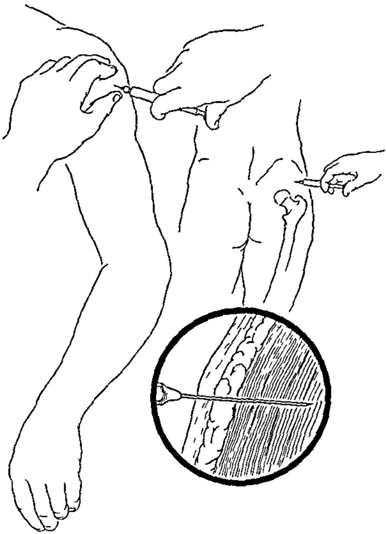


Fig 4 Intramuscular injection A, The upper, outer quadrant of the buttocks should be the site for most intramuscular injections, to avoid damage to vessels and nerves B, Patient in relaxed position for injection into buttocks C, Introduction of needle D, Aspiration to ascertain that the vessel has not been penetrated E Slow introduction of medicant F, Postinjection toilet with alcohol sponge



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sensorium is dulled and the patient is less aware of pain There is a sense of well-being, euphoria and sedation Rarely there may be excitation Following a dose of about 8 mg, given subcutaneously, analgesia, sedation and slight hypnosis are obtained Increasing doses cause central nervous depression (except the vomiting center, which it excites), and stimulation of the spinal cord

Morphine causes an increase in cerebrospinal pressure, and therefore its use is dangerous in patients with head injuries With respiratory center depression, there is also an increase in carbon dioxide and a tendency to respiratory acidosis There is a depression of the cough reflex, depression of ciliary activity, and an increase in bronchoconstrictor tones These reactions are extremely objectionable in the postoperative patient who has intrathoracic secretions Because of the forenamed reactions, the use of morphine is hazardous for the patient with a potentiality of a chest complication Morphine may cause a hyperglycemia that may result in increased blood lactic acid and a glycosuria The vasodilating effect on cutaneous blood vessels combined with over-all quiesence may cause a fall in temperature.

In the gastrointestinal tract, morphine causes delayed gastric emptying, increased intestinal tone, decreased secretions, increase in sphincter tone, decreased motility and constipation This is most evident with repeated usage

The drug may also cause a mild leukopenia followed by a leukocytosis It also causes an increase in smooth muscle tone in the genitourinary tract. It may cause decreased urinary output, increased urgency and increased difficulty with micturition

The cause of death in toxic dosage is respiratory failure An effective antidote is nalorphine partrate (5 mg) or levallorphan (0 5 mg) Tolerance may develop from doses as small as 10 to 15 mg in a period of two to three weeks Addiction may occur before this time Dosage should therefore be as small and as infrequent as possible Tolerance disappears in a few days

√*Indications* Visceral pain

Contraindications Increased intracranial pressure, acute renal damage, bronchial asthma, pruritus In liver disease, beware lest repeated dosage cause a build-up in blood concentration to a degree that toxic concentrations may occur In ureteral colic, additional atropine is necessary In biliary colic the morphine is best combined with papaverine, amyl nitrite, nitroglycerin, theophylline, or similar drugs

Dilaudid (Hymorphan, Dihydromorphine Hydrochloride, NNR)

Dilaudid has essentially the same action as morphine Three mg of this drug is said to raise the pain threshold 100 per cent, while 30 mg of

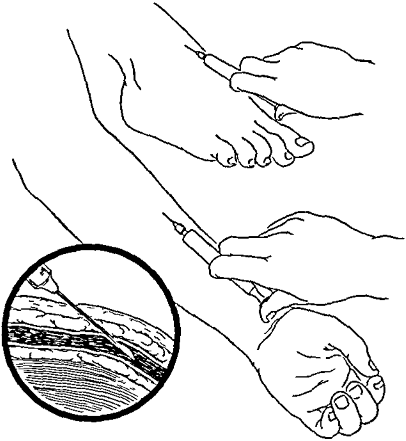

Fig 5 Intravenous injection The preferred sites for this injection are the basilic and median cubital veins of the forearm, occasionally used are the dorsum of the hand, the anterior malleolar veins of the foot, the veins of the leg or the femoral veins In infants the external jugular vein or superior sagittal sinus is used

1 Select needle of length and gauge appropriate to material to be administered. Load syringe and expel air bubbles, or prepare infusion bottle and clear tubing of air

2 With patient in comfortable position, cleanse area with suitable antiseptic and apply tourniquet above site of injection

3 Keeping needle parallel to vein with bevel up, pierce skin and introduce needle gently into vein

4 As soon as blood escapes into syringe or tubing, release tourniquet and begin injection or gravity flow

5 For infusion immobilize needle and tubing with adhesive tape and regulate rate of flow so that no more than 1 liter is delivered in two hours

6 When infusion or injection is completed, apply alcohol saturated cotton to puncture wound with moderate pressure Maintain this pressure for approximately five minutes to avoid hematoma, then apply small dressing to wound

above 150 mg raise the pain threshold very little It depresses the cough reflex much less in equivalent dosage than does morphine or codeine It does cause some rise in intrabiliary pressure, but is more easily neutralized by nitroglycerin and similar drugs than is morphine It has a spasmolytic action in general on smooth muscles It can be said to be equal to morphine in producing analgesia on a 10 to 1 basis, with the limitation of morphine in an 8- to 10-mg level It has less sedative action and only a slight hypnotic or sleep-producing action The euphoriant action is also less than that of morphine It is effective when given orally When used subcutaneously it frequently causes irritation and is therefore best given intramuscularly The untoward reactions are the same as those for morphine but occur with much less frequency Constipation and diarrhea are definitely much less frequent

Demerol can be said to be a mild analgesic with a fairly good safety factor as compared to morphine It is best suited for visceral, cardiovascular and neuromuscular pain It is a good preoperative drug for use when some pain is present, and a good postoperative drug as well The narcotic antagonists are effective against its action also

Methadone

This was one of the first narcotic-like drugs (opioid) to be synthesized It has a 100 per cent threshold raising ability It is effective when given orally It is more potent than morphine, the dosage range being 5 to 15 mg It has the same addiction potentiality as morphine, but the abstinence syndrome is less violent and easier to control Nausea, vomiting and constipation are less frequent than with morphine The effect on smooth muscle is more like that of Demerol than morphine In most other actions it is similar to morphine Its greatest value is its potency, oral effectiveness, and slight sedative and hypnotic activity with minimal gastrointestinal activity An important fact to remember is that this drug is extremely dangerous when given intravenously and is irritating when given intramuscularly and subcutaneously

Nisentil (Alphaprodine)

Nisentil is a potent, short-acting synthetic analgesic, about one-half to one-third as potent as morphine on a weight basis It is another drug that can raise the threshold of pain 100 per cent It is effective given orally and parenterally Its action lasts about one hour Its sedative action is similar to that of Demerol It also has addiction potentialities It has less effect on the bowel than does morphine When given in larger than usual

morphine raises it 90 per cent In other words, Dilaudid is from five to ten times as potent as morphine Its duration of action is slightly less than that of morphine The sedative and euphoragenic properties are less than those of morphine This may be desirable in some patients and undesirable in others The drug has the same liability as to habituation and addiction as does morphine It is more effective orally than morphine and is said to have slightly less effect on the bowel than does morphine It has the same general action on the respiratory tract as morphine It may, at the same time, have a greater antitussive action and be useful when this is desirable

Metopan

Metopon is a very useful drug and it is not clear why it is not used more frequently It has essentially the same action as morphine except a greater effectiveness on a weight basis Three mg of metopon equals about 20 mg of morphine Metopon is effective when given orally Nausea, vomiting and respiratory depression are less frequent than with morphine, but it has somewhat less sedative affect in equivalent dosage

Codeine

This drug has essentially the same actions as morphine, but it has a maximum analgesic threshold of 50 per cent, which is attained by a dosage of 65 mg (1 gram) It produces less central nervous system depression, less sedation, less respiratory depression, and less constipation potential than does morphine Its great value is that it is effective when given orally, especially in combination with such drugs as the salicylates and the para-aminophenols

Although tolerance, habituation and addiction do occur, they are much less likely to be found in good clinical practice than following morphine It must be remembered, however, that tolerance and addiction do occur and with the passage of time these can cause the same problem as does morphine

In the postoperative patient, one must be aware of the antitussive action of the drug, since this may increase the occurrence of postoperative thoracic complications

Demerol (Dolantin, Pethidine, Isonipecaine, Meperidine)

Demerol is a synthetic analgesic that does not have morphine as a parent source In structure as well as properties it resembles morphine and atropine It has an analgesic range between that of codeine and morphine It has a maximum threshold-raising effect of about 60 per cent and doses

above 150 mg raise the pain threshold very little It depresses the cough reflex much less in equivalent dosage than does morphine or codeine It does cause some rise in intrabiliary pressure, but is more easily neutralized by nitroglycerin and similar drugs than is morphine It has a spasmolytic action in general on smooth muscles It can be said to be equal to morphine in producing analgesia on a 10 to 1 basis, with the limitation of morphine in an 8- to 10 mg level It has less sedative action and only a slight hypnotic or sleep-producing action The euphoriant action is also less than that of morphine It is effective when given orally When used subcutaneously it frequently causes irritation and is therefore best given intramuscularly The untoward reactions are the same as those for morphine but occur with much less frequency Constipation and diarrhea are definitely much less frequent

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dosage, 40 to 60 mg, it produces a short period of definite respiratory depression, but in the usual dosage this does not become clinically significant. This drug is ideal for giving relief for painful dressings, such as in burn injuries, and painful manipulations, and the like. It is best administered subcutaneously. With intravenous and intramuscular injections the hazards of respiratory and circulatory depression are markedly increased. The onset of analgesia, even from a subcutaneous injection, occurs in six to ten minutes. The narcotic antagonists are effective against this drug.

Since Nisentil and Demerol are both being used in greater and greater numbers of patients as supplements in the induction of nitrous oxide anesthesia, the physician should consult the anesthesia chart so that he will not give excess amounts of these analgesics in the immediate postoperative period.

Levo-Dromoran (Levorphan)

Levo-Dromoran is the most potent of the opioids (synthetic opium-like narcotics). Two mg. produces pain relief at least equivalent to that given by 10 mg. of morphine. The duration of pain relief is frequently six to eight hours. The drug is as effective given orally as parenterally. It is slightly less constipating than morphine. Its action can be said to be in general like that of morphine in all other ways. It is most useful in the relief of severe chronic pain of carcinoma type. Tolerance and addiction do occur.

GENERAL PRINCIPLES OF PAIN RELIEF

1. *The minimal effective dose should be employed.* The patient should not be given more of a narcotic than is necessary. Larger amounts increase the chance of side reactions and toxicity, and especially tolerance and addiction. The patient's knowledge that he will get relief when he has pain will change his entire outlook and actually make him require less analgesics.

2. *Opiates and opioids should be given as infrequently as possible,* as this will also prevent the possibility of tolerance, addiction and side reactions. A prescription for a narcotic should not be written in such a manner that the patient is given the drug at regular intervals, but rather direction should be given for its administration according to the need. The "p.r.n." should never be accompanied by the "q.", e.g., "Demerol, 100 mg., p.r.n.", rather than "Demerol, 100 mg., q. 4 hours p.r.n." The number of doses should be limited, and in general the drug should rarely be ordered for longer than a two-day period. If pain is not present, the drug should not be given.

3. Analgesics should be given for specific purposes. Use should be made of the salicylates and para-aminophenols, with and without codeine

The narcotics should not be employed unless pain that justifies their use exists

4 One should not let pain become extremely severe before giving a narcotic The earlier the drug is given when an indication exists, the less the suffering, and frequently there will be less total amount used

5 Drugs that cause the least addiction should be employed at first and, if required, gradual progression can be made to the more potent Although cross tolerance does occur, it may be delayed

6 Sedation with barbiturates or similar drugs with the evening or even daytime administration of analgesics may decrease the dosage of analgesics required

7 Potentiators, such as chlorpromazine (Thorazine), diminish reaction to pain and may prolong effect, thereby delaying tolerance and addiction They may also diminish the reaction to pain so that the patient does not mind the pain and requires less narcotics or obtains greater relief from the same dosage

OTHER THERAPY FOR CONTROL OF PAIN

Other measures that may be employed for the control of pain include nerve blocks, physical measures (splints, supports, heat and cold), intravenous procaine injections, application of topical anesthetics, and the use of suction

Nerve Blocks

Nerve blocks may be frequently used to diminish pain They will be of value in the early postoperative period and will aid in coughing, mobilization and ambulation It is unfortunate that few drugs are available whose action lasts for a day and that are safe In some instances, the repetition of a block, even with procaine as the agent, will so diminish the pain that it rarely returns to the degree that it was felt originally

Physical Measures

Massage of stiff, tight muscles or physical exercises, either active or passive, may diminish the pain in a limb or a specific group of muscles

Heat or *cold* by their physical effect may decrease edema and stimulate circulation so as to decrease pain, e g , sitz bath for relief of pain due to genital or hemorrhoidal surgery

Supports placed to diminish spasm of various muscle groups may be of aid, especially in limb surgery

Pillows and similar supports may remove tension from muscle groups and also aid drainage, e g , a pillow placed under the lumbar spine or under a thrombophlebitic limb

Injection of Intravenous Procaine

The intravenous injection of procaine or alcohol may, by central or peripheral action, aid in the control of various types of pain, e g , procaine injection in the patient who has burns

Topical Anesthesia

Topical anesthetics, such as Tronothane, Percaine, Surfacaine, and Xylocaine, may be applied to small areas to relieve pain, as following hemorrhoidectomy Care must be taken in abraded areas that the drug not be absorbed and cause a reaction, and also that skin sensitivity not develop and cause damage

Suction

The correct use of suction to prevent distention is probably one of the most important aids in the decrease of pain Distention is probably the greatest cause of severe abdominal pain It results from ileus, diffusion of anesthetic gases into the lumen of the bowel, and also from intestinal putrefaction and formation of gas "Gas pains" occur even following a spinal anesthesia if ileus develops, and are rarely troublesome if motility is present at the conclusion of an operation, even when ether anesthesia is employed

SUMMARY

Pain is a variable concomitant of surgery Its presence depends upon many factors, such as the operation, the patient's mental state, and the like It can be controlled in many ways All must be used by the wise physician Above all, confidence, assurance and concern on the part of the physician and recognized by the patient will bring great rewards Narcotics, sedatives, potentiators and adjuncts are all of aid The attack should be specific and continuous to be successful

SEDATION

The postoperative patient can benefit markedly through careful and correct sedation By sedation is meant a certain depression of the central nervous system, tending to produce a depression of anxiety, having a calming effect, and reducing apprehension

Barbiturates

ACTION The barbiturates, or similar drugs, when given in large dosage, produce sedative effects and also produce a hypnotic state or a state wherein sleep is encouraged, or, they may actually produce a soporific state

or a state wherein sleep is actually forced It thus becomes obvious that these drugs depress the central nervous system in a manner parallel to their dosage If the dosage is sufficiently large, one may actually produce a state that resembles in many ways and is typical of that induced by the true anesthetic agents

In most instances, however, in the postoperative patient, it is desirable to produce a state of calmness, reducing apprehension This can usually be accomplished by giving relatively small dosages of the barbiturates

In the presence of pain, the barbiturates are less effective unless supplemented by a true analgesic drug If one attempts to use the barbiturates alone in the presence of pain, then one frequently produces an excitement resembling that of the drunken individual who has had alcohol or another similar depressant This occurs because inhibitions are depressed, the individual is truly intoxicated and when pain is present he reacts to this pain as an uninhibited individual would be expected to act. Therefore, barbiturates should be used carefully in the presence of true pain Ideally, in the presence of pain, one would use a narcotic and a barbiturate, especially when both pain and apprehension are present There is a tendency to believe that the combination of the barbiturates and the small dose of the narcotic are probably more effective than either used alone In the presence of integumental, muscular or bone-type pain, the combination of the salicylates, or similar drugs, with the barbiturates gives a good therapeutic effect However, if this integumental pain is extremely severe, it might be wiser to utilize the true narcotic drugs in combination with the barbiturates, or alone

ABSORPTION The barbiturates are absorbed readily from the gastrointestinal tract, the rectum and the intramuscular areas and, of course, they can be absorbed intravenously

DETOXICATION AND ELIMINATION The long-acting barbiturates are eliminated unchanged through the kidney The intermediate-acting barbiturates are partially eliminated by the kidney and partially detoxified by the liver The short-acting barbiturates are detoxified primarily by the liver and then excreted in the urine The ultra short-acting barbiturates are detoxified by the liver and by a process of redistribution It should be noted that the liver is an extremely important organ in the detoxification of those barbiturates which are most useful to the postoperative patient The ability of the liver to destroy, and the kidneys to eliminate, these agents determines to a great degree the duration of action as well as the toxicity or side effects of these compounds In general, the presence of severe hepatic disease would tend to markedly prolong the action of these drugs and cause them to be harmful, although this does not necessarily follow, the authors per-

sonally know of no cases in which the harm has been clearly demonstrated

IDIOSYNCRASIES AND CONTRAINDICATIONS It is important, when using the barbiturates and similar drugs, that one obtain a careful history as to the past use of these agents by the patient Frequently it will be revealed that one or the other of the drugs has produced the desired effects, while another has caused extreme excitement, nausea, vomiting, delirium, or other undes rable side reactions Those agents which have proved themselves in the past to be satisfactory in a particular patient should be utilized for that patient Untoward reactions are probably more common when hepatic and renal dysfunction exist and when fever, severe anemia, congestive failure and other similar severe metabolic disease states are present

CLASSIFICATION

LONG-ACTING
- Phenobarbital
- Barbital

INTERMEDIATE
- Neonal
- Dial
- Ipral
- Alurate
- Nostal
- Amytal

SHORT-ACTING
- Sandoptal
- Pentobarbital (Nembutal)
- Phanodorn
- Ortal
- Seconal

ULTRA SHORT-ACTING
- Evipal
- Pentothal (Thionembutal)
- Surital (Thioseconal)
- Cyclobarbiturates (all types)

In general, the intermediate and short-acting barbiturates are most useful in the postoperative period

DOSAGE

Seconal Sodium—Dosage Table (for Sedation)

AGE	DOSAGE	ROUTE
1–3 months	0 016 –0 325 gm (1/4–1/2 grain)	Rectal
3–6 months	0 0325–0 05 gm (1/4–3/4 grain)	Rectal
6–36 months	0 05 –0 065 gm (3/4–1 grain) 0 05 gm (3/4 grain)	Rectal Oral
3–8 years	0 05 –0 1 gm (3/4–1 1/2 grains)	Rectal
8–15 years	0 05 –0 1 gm (3/4–1 1/2 grains) 0 065 –0 1 gm (1–1 1/2 grains)	Oral Rectal

Summary of Common Barbiturates

DRUG	DOSE HYPNOTIC	ACTION	USES	DURATION
Dial	0.1–0.3 gm	Intermediate	Hypnotic	6–10 hrs
Neonal	0.05–0.10 gm	Intermediate	Hypnotic	6–10 hrs
Amytal	0.1–0.3 gm	Short	Hypnotic, narcotherapy, preanesthetic agent, anticonvulsant	4–8 hrs
Pentobarbital (Nembutal)	0.1–0.2 gm	Short	Hypnotic, narcotherapy, preanesthetic agent, anticonvulsant	4–8 hrs
Seconal	0.1–0.3 gm	Short	Hypnotic, narcotherapy, preanesthetic agent, anticonvulsant	4–8 hrs

The barbiturates should be administered in rather cautious dosage. The authors prefer to give half of the expected dose intravenously and then watch the response and add the amount needed to the intravenous infusion. Or, if an infusion is not being utilized, there are adequate preparations of almost all of the common ultra-short and short-acting barbiturates available in an injectable form that may be used intramuscularly.

Chloral Hydrate

Chloral hydrate is an excellent sedative in the postoperative patient in that it is less apt to produce disorientation in the senile patient than do the barbiturates. The respirations are usually slowed to a sleep-type rhythm; there is, however, no analgesic action and, when given in the presence of pain, restlessness will be produced. It must also be pointed out that chloral hydrate is destroyed in the liver and therefore the same relative contraindications exist for this drug as for the barbiturates.

Paraldehyde

This drug is preferred as a sedative for patients having brain injury because it tends to depress the respirations to a lesser degree than do the

other agents, sometimes the respirations seem to be even slightly stimulated It is an excellent, safe sedative The major objection is its pungent, disagreeable odor It is generally given in a form of what one might loosely call a "mixture-type cocktail" by rectum or through a stomach tube It is eliminated, at least to a markedly significant degree, by the lungs

Basal Anesthetics and True Anesthetics

The basal anesthetic agents, such as Avertin, or the true anesthetic agents, such as Pentothal, as Thionembutal or Surital, as Thioseconal, may be given intravenously or rectally when indicated Primarily these drugs are utilized in children for the production of a sleep-like state They should, however, be prescribed only by those who have experience in their use, because this deep sleep-like state is essentially an anesthetic state if enough of the drug is utilized

Tranquilizing Agents

Recently, Thorazine, Phenergan or Pacatal, all three being phenathiazine derivatives with an action which is essentially tranquilizing or relaxing, has been employed in combination with the sedatives and analgesics to produce a longer period of quiescence that may be of benefit to the patient However, these tranquilizing agents should be prescribed primarily by individuals who know the particular drug, its side actions and hazards In many patients they produce a state of detachment from pain that is to be markedly desired

ANTIBIOTIC AND CHEMOTHERAPEUTIC AGENTS

The use of antibiotics and similar chemotherapeutic agents in the intensive therapy or recovery unit should be secondary to the maintenance of respiration and circulation and other resuscitative procedures These agents should not be used promiscuously An adequate history of previous use must be taken prior to their administration, and generally there should be a specific indication Whenever possible, an attempt to obtain a culture of a contaminated area should be performed with the concomitant use of sensitivity tests prior to initiation of therapy When it is impossible to obtain cultures and it is necessary to administer these agents, clinical judgment as to the type of bacteria or infective agent must be relied upon to determine which agent is indicated In most instances the antibiotic or chemotherapeutic agent must be administered parenterally and therefore a wide assortment of such agents should be readily available

After an intelligent selection of an antibiotic has been made, there should be an adequate trial to determine its effectiveness Shifting from one anti-

biotic to another is a practice to be condemned, unless cultures reveal greater sensitivity to other agents than the one employed

In postoperative patients, unless there has been known large-scale contamination or unless there is pre-existing infection, such as acute appendicitis, antibiotics and other chemotherapeutic agents should largely be withheld until their need is indicated and then they should be used, if possible, following culture and sensitivity tests

The specific therapy for most soft-tissue infections and diseases associated with the various systems has been described elsewhere in the text, and therefore only a general discussion of the principles of the usage of the antibiotics and chemotherapeutic agents will be given here

PENICILLIN

Penicillin is still "the old reliable" as far as an antibiotic is concerned, especially for the more common types of infections secondary to staphylococcus invasion and in general for most of the infections due to cocci—both gram-positive and gram-negative It is available for parenteral use in aqueous crystalline forms for securing rapid blood levels and in combination with suspending agents for more slow absorption Most ampules of penicillin now contain a combination of rapidly absorbable penicillin as well as the slow absorption type An average daily dose is 400,000 to 600,000 units If more than 500,000 units are administered daily, about 10 per cent of those so treated will show sensitivity which may be partially counteracted with an antihistaminic or other anallergen Modifications of dosages depend upon the severity of the infection and course In most instances, if there is need for the agent, it should be given several days after its obvious need has been manifest

STREPTOMYCIN

Streptomycin and dihydrostreptomycin are especially effective against gram-negative organisms and against the tubercle bacillus These drugs are generally given in mixtures of equal parts to diminish neurotoxic reactions The average dose is 0 5 gm, to be given twice daily

Penicillin and streptomycin are apparently synergistic and together offer a broad spectrum antibiotic which is less expensive than some of the newer wide-spectrum agents In most of the gastrointestinal infections due to beta streptococci and enterococci, and when these organisms have contaminated the peritoneal cavity, combinations of penicillin and streptomycin should be administered in massive doses, i e, 1,000,000 units of penicillin and 1 to 2 gm of streptomycin

The Efficacy of Practical Antibiotics*

ORGANISM	COMMON SYNONYMS	DISEASE	PENICILLIN	ERYTHROMYCIN	STREPTOMYCIN	CARBOMYCIN	TETRACYCLINE[1]	CHLORTETRACYCLINE	OXYTETRACYCLINE	CHLORAMPHENICOL	NEOMYCIN[2]	BACITRACIN	POLYMYXIN	TYROTHRICIN	REMARKS
			PRIMARILY SYSTEMIC→								←PRIMARILY TOPICAL				
Pseudomonas aeruginosa	Bacillus pyocyaneus	Wound and urinary infections bacteremia	4	4	1	4	3	1	1	2	1	4	1	4	Systemic neomycin or polymyxin alone or combined may be lifesaving sulfonamides effective
Micrococcus pyogenes var aureus	Staphylococcus aureus	Suppurative processes	1	1	1	1	1	1	1	1	1	1	3	1	Try penicillin or erythromycin first test sensitivity combinations valuable
pyogenes var albus	Staphylococcus albus	Suppurative processes	1	1	1	1	1	1	1	1	1	1	4	1	
Neisseria gonorrhoeae	Gonococcus	Gonorrhea	1	1	1	1	1	1	1	1	3	1	3	3	Try penicillin first sulfonamides effective
meningitidis	Diplococcus intracellularis Meningococcus intracellularis	Epidemic meningitis	1	1	3	3	1	1	1	1	3	1	4	3	
Diplococcus pneumoniae	Pneumococcus	Pneumonia meningitis endocarditis pericarditis etc	1	1	1	1	1	1	1	1	3	1	4	1	Try penicillin first sulfonamides also effective
PYOGENIC GROUP [A β]															
Streptococcus pyogenes	S hemolyticus S var scarlatinae	*Inflammatory exudates* blood stream and other infections	1	1	1	1	1	1	1	1	1	1	4	1	Combined penicillin and streptomycin in severe infections and subacute bacterial endocarditis sulfonamides also effective
VIRIDANS GROUP [α]															
Streptococcus salivarius mitis bovis	S cardio arthritidis S mitior seu viridans S inulinaceus	Oral abscesses respiratory infections subacute endocarditis etc	1	1	1	1	1	1	1	1	3	1	4	1	Combined penicillin and streptomycin in severe infections and subacute bacterial endocarditis topical bacitracin in upper respiratory infections
LACTIC GROUP [N]															
Streptococcus lactis	S acidi lactici	Very rarely pathogenic	1	3	3	1	—	1	1	3	—	1	—	—	
ENTEROCOCCIC GROUP [D]															
Streptococcus faecalis liquifaciens	Enterococcus proteiformis S coli gracilis	Inflammatory exudates blood stream in subacute bacterial endocarditis	1	1	1	1	1	1	1	1	1	1	4	3	Combined penicillin and streptomycin in subacute bacterial endocarditis

The Efficacy of Practical Antibiotics (continued)

	ANAEROBIC SPECIES														
Streptococcus anaerobius, foetidus, putridus, micros, intermedius, evolutus		Putrefactive infections: puerperal infection, appendicitis, pleurisy, osteomyelitis, etc.	1	—	—	—	3	1	1	1	1	1	—	3	Try penicillin and tetracycline first
Escherichia coli	Bacillus coli communis	Peritonitis, urinary tract infections, bacteremia, etc.	4	4	1	4	1	1	1	1	1	4	1	4	Oral neomycin for infantile diarrheas and intestinal antisepsis; try tetracycline with streptomycin in urinary infections; test sensitivity
Aerobacter aerogenes	Bacillus aerogenes	Urinary tract infections, meningitis, etc.	4	4	1	4	1	1	1	1	1	4	1	4	Combine streptomycin with a tetracycline; try oral neomycin for intestinal antisepsis
Klebsiella pneumoniae	Friedlander's pneumobacillus	Respiratory tract infections	1	4	1	4	1	1	1	1	2	4	1	4	Combined penicillin with streptomycin or a tetracycline with chloramphenicol may be useful; try oral neomycin for intestinal antisepsis
Proteus vulgaris	Bacillus vulgaris	Gastroenteritis, peritonitis, urinary tract infections, etc.	1	4	1	4	3	3	1	1	1	4	3	4	Try neomycin or streptomycin first; differences in strain sensitivities demand tests for bacterial sensitivity
mirabilis	Bacillus mirabilis														
morganii	Morgan's bacillus type 1														
Salmonella paratyphi	Bacillus paratyphosus A	Enteric fever	4	4	1	4	3	3	3	1	3	4	3	4	Antibiotics may not be specific but afford relief; try combinations of streptomycin or chloramphenicol with sulfonamides; for typhoid fever try chloramphenicol alone or with tetracyclines, or synnematin B (new antibiotic); the latter may even eradicate carrier states
schottmuelleri	Bacillus paratyphosus B	Enteric fever	3	4	1	4	3	3	3	1	1	4	3	—	
typhimurium	Bacillus aertrycke	Food poisoning	3	4	3	—	—	3	3	2	1	4	2	—	
hirschfeldii	Bacillus paratyphosus C	Enteric fever	4	4	4	—	—	—	—	—	1	4	—	—	
choleraesuis	Bacillus suipestifer	Gastroenteritis	4	4	4	4	—	3	1	1	—	4	3	—	
typhosa	Typhoid bacillus, Eberthella typhosa	Typhoid fever	2	4	2	4	1	1	1	1	2	4	3	4	
enteritidis	Bacillus enteritidis	Food poisoning	3	4	2	—	—	3	2	3	3	4	3	—	
Shigella dysenteriae	Bacillus dysenteriae Shiga	Dysentery	4	3	1	4	3	1	1	1	3	4	1	4	Try sulfonamides; oral polymyxin available; bacitracin occasionally effective
paradysenteriae	Bacillus dysenteriae Flexner	Dysentery and summer diarrhea in children	4	3		—	1	1	1	1	3	4	1	4	
sonnei	Bacillus dysenteriae var. sonnei		4	3	1	4	1	1	1	1	3	4	1	1	
Donovania granulomatis	Donovan bodies	Granuloma inguinale	3	1	1	1	—	1	1	1	1	3	—	4	
Bacteroides funduliformis	Bacillus funduliformis	Puerperal infection, appendicitis, and urinary infection	3	1	1	—	1	1	1	—	4	—	—	—	Try tetracyclines; combined antibiotic therapy may be useful
Haemophilus influenzae	Koch-Weeks bacillus	Respiratory tract infections, meningitis	2	1	1	2	1	1	1	1	3	4	1	3	Use streptomycin or chloramphenicol until sensitivity tests are done; sulfonamides valuable in combinations
pertussis	Bordet-Gengou bacillus	Whooping cough	1?	1?	2	3	1?	1?	1?	1?	3	4	1?	—	Specific value of antibiotics questionable; use of hyperimmune serum has been recommended
ducreyi	Bacillus ulceris cancrosi	Soft chancre	4	1	1	—	1	1	1	1	—	4	3	3	Sulfonamides effective, especially when combined with streptomycin

*The Efficacy of Practical Antibiotics**

			PRIMARILY SYSTEMIC→								| ←PRIMARILY TOPICAL				
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Streptococcus salivarius mitis bovis	S cardioarthritidis S mitior seu viridans S inulinaceus	Oral *abscesses respiratory* infections subacute endocarditis etc	1	1	1	1	1	1	1	1	3	1	4	1	Combined penicillin and streptomycin in severe infections and subacute bacterial endocarditis topical bacitracin in upper respiratory infections
LACTIC GROUP [N]															
Streptococcus lactis	S acidi lactici	Very rarely pathogenic	1	3	3	1	—	1	1	3	—	1	—	—	
ENTEROCOCCIC GROUP [D]															
Streptococcus faecalis liquefaciens	Enterococcus proteiformis S coli gracilis	Inflammatory exudates bloodstream in subacute bacterial endocarditis	1	1	1	1	1	1	1	1	1	1	4	3	Combined penicillin and streptomycin in subacute bacterial endocarditis

The therapy for acute gastric dilatation is immediate evacuation of the stomach by the use of properly functioning gastrointestinal suction In the usual patient, after a Levin tube has been inserted and Wangensteen suction has been initiated, there is dramatic improvement As in any type of therapy, preventive measures are the best treatment Patients having back injuries, traumatic surgical procedures, or other conditions conducive to the development of dilatation should have Wangensteen suction instituted during the early phase of treatment, with discontinuance of the suction as soon as there is evidence of return of peristalsis, in order to obviate the loss of electrolytes and other substances The therapy, in addition to proper suction to relieve the distention, should include the restoration of water and electrolyte loss, which, in the case of intestinal atony, may be severe

Abdominal distention, whether due to ileus or primary gastric atony, must be prevented whenever possible When it occurs it should be treated with adequate gastrointestinal suction The ill consequences of abdominal distention are discussed as a primary cause of postsurgical complications in the section of Chapter 3 on the management of respiration The patient requiring suction, of course, will need parenteral nutrition as outlined in the section on nutrition in Chapter 3

NAUSEA AND VOMITING

Etiological Factors

Deep anesthesia, anesthesia of long duration, and certain anesthetic agents, such as ether and those resembling ether, are factors in the causation of postoperative nausea It is also known that females seem to have a higher incidence of nausea and vomiting than do males Rough handling of the bowel, ileus and distention are all surgical causes of nausea and vomiting Many individuals have nausea and vomiting following the administration of various narcotic drugs, such as morphine Emotional factors, psychological factors, hypoglycemia, and electrolyte imbalance can dispose to this condition Oxygen want, high spinal anesthesia, carbon dioxide excess, and shock, as well as hypotension of any significant duration, are also etiological factors

Prophylaxis and Treatment

Sedation with the barbiturates as well as elimination of any narcotic agents that the patient's history showed responsible for nausea and vomiting at some previous time, with substitution of other narcotic agents, may be of value in preventing the condition The anesthesia should be without

ACUTE GASTRIC DILATATION AND ABDOMINAL DISTENTION

Acute gastric dilatation may occur in the first few days postoperatively and is characterized by loss of gastric tone with marked distention of the stomach from the accumulation of air and secretions The entire abdominal cavity may become filled with the distended stomach and, unless the condition is recognized and treated, collapse and even death may result

Abdominal distention, whether from paralytic ileus or gastric dilatation, is a threat to the life of the patient and every precaution should be taken to avoid it Although the distention most commonly occurs after abdominal surgery, especially when there has been considerable trauma, it may result from injury to the back, intrathoracic surgical procedures, or *any surgery requiring anesthesia*

Acute gastric dilatation and paralytic ileus apparently are due to inhibition of the autonomic pathways of the motor nerves to the stomach and intestines Injury to the back, as is so common now in auto accidents, may result in profound distention Manipulation of the viscera during surgery in certain patients seems to interfere with early return of tone to the stomach and intestines Overdistention of the stomach by improperly forcing anesthetic gases into the stomach may produce a gastric dilatation during surgery Acute gastric dilatation and abdominal distention may result from continuous swallowing of air which may occur on the return of consciousness The use of oxygen administered through a catheter extending into the oropharynx, may produce severe gastric dilatation, as previously stated Patients with nausea may swallow air to relieve their unpleasant symptoms and certain patients accumulate air in the stomach naturally during breathing, which produces dilatation if there is gastric atomy Occasionally, putrefaction of undigested foodstuff also contribute to the accumulation of air in the upper gastrointestinal tract

Postoperative gastric dilatation may be difficult to diagnose The patient may gradually distend without vomiting until the abdomen is markedly protuberant The onset of symptoms is often characterized by sudden increase of the pulse and respiration rates, associated with hypotension, clammy skin and all the signs of shock When a shock-like condition develops in the immediate postoperative period without other causative reason the diagnosis of acute gastric dilatation should be suspected and if the condition is present therapy should be instituted promptly The authors have seen a postoperative patient with an acute onset of a distended, board-like abdomen, who was returned to the operating room with the diagnosis of a ruptured viscus, at operation it was discovered that the abdomen was filled with a severely distended stomach that resulted partly from a nonfunctioning stomach suction tube

One or two tablets a day cause mild sedation and, in the experience of some, have been helpful in the control of nausea and vomiting

Pyridoxine is another drug which has been found helpful in the control of certain types of nausea and vomiting It is available in 50- and 100-mg tablets

Thorazine (chlorpromazine) is another of the antihistaminic and anticholinergic sedative drugs that is said to aid in the control of postoperative nausea and vomiting This drug, however, should be used in dosages of 5 or 10 mg and given with the anesthetic At the termination of the operation, small increments of 10 mg at a time may be added to the intravenous infusion If the infusion has been discontinued, a deep intramuscular injection can be given Care should be taken that the dosage be no larger than 10 mg and that there is no hypotension or excess depression from narcotic agents or anesthetic drugs at the time of administration

Although the control of nausea and vomiting may be aided in general by these antiemetic vomiting drugs, prevention of distention, sedation, good fluid balance, good acid-base balance and maintenance of good respiration and circulation are probably more important Above all else, the maintenance of an adequately functioning indwelling intestinal tube is paramount.

HICCOUGH

Postoperative hiccough is not uncommon Concomitant with spasmodic contractions of the diaphragm there is closure of the glottis which impedes inspiration and thereby produces the sound characteristic of hiccough Hiccoughing may be secondary to central nervous system disorders, in the surgical patient it is most likely due to hypoxia of the centers controlling the respiratory muscles Since the reflex passes through the phrenic nerve, it may also be due to irritation of the nervous pathways, especially in patients having operations resulting in trauma to the phrenic nerve

In the immediate postoperative period, hiccoughs are almost always initiated by irritation of the diaphragm, either directly by gastric dilatation or secondary to a chemical or bacterial inflammation of the subdiaphragmatic area Distention of the intestine, either secondary to paralytic ileus or due to intestinal obstruction, may produce hiccoughs Surgery upon any of the upper abdominal organs, i e , stomach, gallbladder, liver, pancreas, or spleen, is particularly prone to cause irritation of the diaphragm which may initiate hiccoughs

Gastric lavage should be instituted in any patient with continuous hiccoughs that appear immediately postoperatively The emptying of the stomach will be successful in the control of hiccough in a high percentage

excess carbon dioxide as well as without oxygen want Shock and its forerunner, hypotension, should be prevented by the careful administration of blood and/or intravenous fluids and other appropriate adjunctive measures Careful handling of the bowel to prevent ileus, the early insertion of an indwelling intestinal tube and aspiration of intraluminal contents will also be helpful The use of the rectal tube to decompress the lower bowel may also help in some instances Measures for the prevention and treatment of the aforementioned etiological factors should be carried out

Prior to the termination of an operation, the secretions in the mouth should be removed as well as those in the trachea while the patient is still somewhat under the effect of the anesthetic, so that violent coughing and retching are not stimulated on emergence The patient can be turned on his side and the airway removed rather early in order that the mechanical airway will not stimulate the gag reflex

Careful administration of fluids and electrolytes to give adequate hydration and good electrolytic balance may also prevent nausea and vomiting

Recently a number of drugs have gained popularity in the treatment and prevention of nausea and vomiting These drugs may loosely be called the antiemetic drugs, and various studies would indicate varying degrees of effectivity

One of the drugs is Marezine (cyclizine lactate) This may be given in a 50-mg dose, or 1 cc, intramuscularly, approximately one hour before the termination of the operation Or 50 mg may be injected intramuscularly three times a day if vomiting should occur in a patient who has been unprepared or in one in whom the single injection has been ineffectual In children the doses should possibly be about 25 mg Marezine is an anticholinergic and an antihistaminic compound that has as a concomitant a slight sedative effect and causes some dryness of the mouth

Another drug that is used in the treatment of nausea and vomiting is Dramamine (dimenhydrinate) This is available in ampules, tablets, suppositories and liquid The usual dosage is 50 mg, administered four to six hours prior to surgery This may give the patient slight sedation and be of aid in the premedication therapy Prior to the termination of anesthesia, another 50 mg may be given Similar doses may be administered every four to six hours as required

Bonamine (meclizine, Bonadoxin) is another compound being used in the control of nausea and vomiting This also has a slight anticholinergic and antihistaminic property, producing in some patients a little dryness and a sedative effect It is available in tablets as well as in chewing gum

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of the subjects If considerable drainage from the stomach is noted when gastric lavage is performed, continuous Wangensteen suction should be instituted to prevent recurrence

If the hiccoughs have been intermittent and there is no other indication of gastric dilatation, simple measures may bring about cessation of hiccoughing Releasing a tight abdominal binder, loosening the dressing, and mobilization of the patient by turning, elevating the bed, or other means may be adequate Carbon dioxide inhalation therapy is easily carried out in the recovery room, since a small tank of carbon dioxide should always be on hand By attaching a piece of anesthesia tubing onto the tank, it is possible to give direct inhalation of this gas, but this should be kept at a minimum—the patient should be permitted no more than eight to ten breaths of the gas at any one treatment If the patient complains of giddiness, even less should be administered Often a few breaths of carbon dioxide will be sufficient, if the hiccoughs are reflex in nature this will usually give relief

If other measures fail, procaine or a longer-acting local anesthetic agent, introduced through a polyethylene catheter for intermittent injection of the phrenic nerve, may produce a cessation of symptoms This nerve block should not be done except as a last resort, since paralysis of the diaphragm may produce thoracic complications

Mild sedation productive of sleep may break the hiccough reflex Some of the antiemetic drugs, e g , Thorazine, may likewise produce cessation of the symptoms Agents which irritate or depress the gastric mucosa also have, on occasions, proved effectual

WOUND DEHISCENCE

Rarely does the wound break open during the immediate postoperative period Abdominal wound disruptions occur in less than 1 per cent of postoperative patients and in those usually only after the third or fourth postoperative day However, a severely cachetic patient, with abdominal distention, and engaging in violent coughing, may split his wound even during the early postoperative phase

Preventive measures should be taken preoperatively to improve nutrition as much as possible and to eliminate factors which might cause poor healing, vitamin deficiencies, water and electrolyte deficits, hypovolemia and hypoproteinemia should be corrected Measures should be taken to eliminate irritants that will stimulate coughing, such as poor oral hygiene, sinus infections, and excessive use of tobacco At operation, of course, surgical trauma should be kept at a minimum to prevent postoperative distention During the closure of the wound, proper relaxation should be

maintained so that the sutures may be placed properly without tearing of the tissues The authors believe that the type of suture material is not necessarily an important factor if proper technique is maintained and the suture is stronger than the tissues, although many believe there are less wound disruptions when nonabsorbable sutures are employed If the operation has been an emergency one and contributing causes exist without time to correct them, such as marked cachexia, poor nutrition and chronic cough, then it may be wise to effect wound closure by including through-and through wire retention sutures

The onset of a wound separation is often described by the patient as "feeling something give" while coughing or turning The objective sign that almost invariably means a wound disruption is the sudden seepage of a serosanguinous fluid from an area of the wound that previously had not drained The wound, when examined, usually has an "unhealed appearance," as though there has been no deposition of fibrin between the wound edges After the area has been carefully cleansed, utilizing sterile technique, a sterile probe or small hemostat may be passed through the wound edges to determine if there is deep separation Occasionally, the serum will have drained from a subcutaneous hematoma If bowel is visible, the disruption is, of course, manifest If evisceration of bowel occurs, there should be replacement of the intestine and, in most instances, the patient should be returned to operating room, given an anesthetic and the wound reclosed with through-and-through wire sutures, it being made certain that obstruction and strangulation of a loop of bowel have not resulted from the dehiscence Occasionally the patient will be in too critical a condition to return to the operating room In such an instance the bowel should be cleansed with sterile saline solution and replaced in the recovery room, a sterile set-up being employed The intestine must be replaced without damage and covered by loosely suturing the skin or pulling the skin together with adhesive tape The authors believe, however, that in almost all instances the disruption can and should be repaired in the operating room

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If the hiccoughs have been intermittent and there is no other indication of gastric dilatation, simple measures may bring about cessation of hiccoughing Releasing a tight abdominal binder, loosening the dressing, and mobilization of the patient by turning, elevating the bed, or other means may be adequate Carbon dioxide inhalation therapy is easily carried out in the recovery room, since a small tank of carbon dioxide should always be on hand By attaching a piece of anesthesia tubing onto the tank, it is possible to give direct inhalation of this gas, but this should be kept at a minimum—the patient should be permitted no more than eight to ten breaths of the gas at any one treatment If the patient complains of giddiness, even less should be administered Often a few breaths of carbon dioxide will be sufficient, if the hiccoughs are reflex in nature this will usually give relief

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WOUND DEHISCENCE

Rarely does the wound break open during the immediate postoperative period Abdominal wound disruptions occur in less than 1 per cent of postoperative patients and in those usually only after the third or fourth postoperative day However, a severely cachetic patient, with abdominal distention, and engaging in violent coughing, may split his wound even during the early postoperative phase

Preventive measures should be taken preoperatively to improve nutrition as much as possible and to eliminate factors which might cause poor healing, vitamin deficiencies, water and electrolyte deficits, hypovolemia and hypoproteinemia should be corrected Measures should be taken to eliminate irritants that will stimulate coughing, such as poor oral hygiene, sinus infections, and excessive use of tobacco At operation, of course, surgical trauma should be kept at a minimum to prevent postoperative distention During the closure of the wound, proper relaxation should be

The history and physical examination may indicate that a flat plate of the chest should be obtained and that an electrocardiogram and further special studies be made In attempting to restore the patient to as near a normal state as possible, insipient edema and low plasma protein may require correction and the patient may need to be digitalized or given cortisone or other drugs, as indicated

The factors determining the maintenance of circulation are basically four in number

1 The state of the nervous system
   a The higher centers
   b Pituitary
   c. Medulla
   d Autonomic nervous system, including the sympathetic and parasympathetic
2 The state of the cardiovascular-respiratory system
   a Cardiac output
   b Peripheral resistance
   c Total blood volume
   d Blood viscosity
   e Elasticity of tone of vessels
   f Pulmonary bed
3 Respiratory exchange
4 Humoral factors—these include the pituitary, adrenals, thyroid, liver, kidneys

In general, all these factors contribute towards the maintenance of circulation, and, dependent upon the degree of dysfunction of any individual factor, one may have a complete and total failure of the circulation The neglect of any one of these factors may mean circulatory failure More simply stated, the maintenance of circulation is dependent upon the cardiac output which is primarily dependent upon the stroke volume and the minute volume of the heart, and this in turn is dependent upon the return circulation to the heart Another important factor is peripheral resistance and this is a variable with the tone and state of the peripheral vascular bed

When failure occurs, it may be a central failure, that is, of the heart itself, or a peripheral failure of the vascular bed

FACTORS ALTERING CIRCULATION DURING SURGERY

The anesthetic and the preanesthetic drugs in general are all cardiovascular depressants It would be well to point out that morphine and the narcotic drugs are all depressants upon the vasoaccommodative system,

Chapter 3

MANAGEMENT OF CIRCULATION, SHOCK, RESPIRATION AND NUTRITION

MAX S SADOVE, M D, and JAMES H CROSS, M D

CIRCULATION

If one can prevent the occurrence of circulatory failure, this is far more important than an adequate knowledge of its treatment The correction of certain defects and the knowledge of various pathological states are important factors in diminishing the incidence of shock or circulatory failure A careful examination of the patient as well as a careful history will start one on the road to the correct preparation of the patient for surgery It cannot be overemphasized that the knowledge of the patient's hemoglobin level, hematocrit reading and circulating blood volume as well as a knowledge of his cardiac status is an integral portion of the preparation of every patient for operation Recently information has accrued which should point to the fact that knowledge of the hematocrit and hemoglobin levels, although valuable information, is not nearly as valuable as the knowledge of the patient s circulating volume With the development of the relatively simple Evan's blue volume determination technique and the radioactive chromium and albumin volume determination techniques it is now possible to determine the actual circulating blood volume It has been found by many that although the amount of blood available, as indicated by the hematocrit and hemoglobin levels, appeared normal, when the patient is studied from the standpoint of actual volume, one frequently finds that there is a marked deficit This is especially true in the patient who has had chronic bleeding of a mild degree, such as the woman with menorrhagia or the patient who has a mild bleeding ulcer or bleeding hemorrhoids

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that is, there is a depression of the ability of the body to accommodate itself or compensate for blood loss, change in position of the patient, and the like When shock exists, therefore, these drugs must be used very cautiously, if at all Small amounts sufficient to cause light sedation probably would be relatively harmless Even these small amounts may add to the burden of the patient who is already in a state of compensated shock The drying agents such as atropine and scopolamine tend to increase tachycardia which, if not too severe, may increase cardiac output, but would have a tendency to hide the true state of the circulation, since the pulse and the changes in pulse rate are probably one of the most important factors in the determination of the vascular state

Anesthetic Agents

Pentothal, Avertin, the barbiturates and ether all tend to potentiate the shock state, especially if the shock is due to blood loss Not only is there depression of the vasoaccommodative center, but frequently there is mild depression of the cardiac mechanism as well as a peripheral vasodilatation With time and/or increased depth, there is a tendency for the vessels to undergo a dilatation and there also occurs a loss of fluid from the vascular bed into the interstitial spaces, potentiating shock

Cyclopropane, on the other hand, is an excellent drug for the patient who is having a bleeding episode because it tends to produce bradycardia which could increase the stroke volume of the heart, coronary flow and cardiac efficiency Cyclopropane also may produce a mild carbon dioxide accumulation which tends to maintain peripheral circulation unless it is excessive, and it may increase the peripheral vasoconstrictor tone, making it the ideal general anesthetic for the patient in incipient or potential shock

Since spinal anesthesia tends to increase peripheral vasodilatation, its use is hazardous for the patient who is in a state of potential shock

Regional anesthesia, induced by agents that do not produce vasodilatation of any significance, is excellent for the potential shock patient undergoing surgery

Bleeding

Bleeding is a concomitant of surgery or it may actually precede the operation Whether the bleeding is external or internal, such as into bowel or muscle, makes little difference, since any blood escaping from the effective circulation is lost as far as over-all circulatory efficiency is concerned Bleeding may be chronic or acute The more chronic the bleeding, the more severe may be the total loss with relatively little signs of circulatory

insufficiency It is not at all uncommon to see patients arrive in the operating room with practically normal hematocrit and hemoglobin levels and only a mild tachycardia, in whom the circulatory volume is found to be as low as a third or one half of that expected In other instances, one is amazed to find hematocrit or hemoglobin levels of approximately a third or a quarter of the normal value in patients who have been doing their daily work without evidence or with little history suggestive of this state

The blood vessels' ability to vasoconstrict and shut off from the circulation large segments of the body tissue and thus compensate is truly remarkable By looking at the patient, one may suspect that there is a circulatory deficit, but it is only after definite tests are performed that one realizes the degree of loss In some patients there may not be actual bleeding but rather a destruction or failure to produce blood, as in the specific anemias Nutritional deficiencies or peculiar diets may lead to severe anemias associated with relatively no findings These patients tolerate little insult during anesthesia and surgery Careless induction of anesthesia or a small amount of blood loss may break the body's compensation, with the result that decompensation occurs

Hypovolemia

Hypovolemia is a state of reduced circulating blood volume The condition occurs when there is either a rapid or slow steady loss of blood or when there is failure to manufacture adequate blood When it has an acute, etiological basis, it has frequently been called chronic or compensated shock In general, the blood pressure in patients with hypovolemia may be essentially normal, but there is usually a tachycardia The severity of the state, to a great degree, is proportional to this tachycardia In fact, many consider the rate of the pulse to be much more significant than the blood pressure We prefer not to start administration of an anesthetic to any patient who has a pulse rate of over 120 per minute Of course, this is not always possible, but we consider this rate to be indicative of circulatory failure When restituting blood volume, important guides to the state of the patient's circulation are the rate of the pulse, tone and color of the skin, amount of perspiration, nervousness and irritability If the pulse rate is above 140, we feel that it is mandatory that corrective measures be taken before anesthesia is induced

The blood pressure, although important, is frequently overemphasized There should be less concern about a patient with a blood pressure of 90 who has a pulse rate of 80 than about a patient who has a blood pressure of 120 with a pulse rate of 120 In addition, the patient with a tachycardia has reduced cardiac efficiency and the relative coronary flow is also

inefficient When possible, intravenous infusions should be started and the patient given enough blood and/or fluids to bring the pulse rate to below 120, preferably in the vicinity of 100, and to initiate a rising blood pressure

It is difficult to distinguish between a tachycardia that results from a possible failing central mechanism, such as toxic myocarditis, valvular heart disease, or similar states, from a tachycardia that results from such various factors as general toxemia and electrolyte imbalance Only a careful history, observation and clinical judgment will enable one to make his distinction

Reflexes

Reflexes are often blamed for many pathophysiological varieties ranging from slight tachycardia or headache to severe states such as cardiac arrest In general, it should be remembered that the internal control of all vital processes, to a great degree, depends upon these various reflexes as well as the slower humoral control mechanisms However, when a patient is in a precarious condition, such as exists with excess carbon dioxide or insufficient oxygenation of the tissues, a stimulus, such as the movement of a fractured leg which ordinarily may cause very little difficulty, may actually cause a complete circulatory collapse or failure of the heart due to reflex standstill It can be demonstrated by our modern recording instruments that a tugging on the stomach or other visceral structures, or any highly innervated tissue, may cause circulatory changes Gentleness in handling of tissues and blocking areas in which strong stimuli are occurring by employing local anesthesia are helpful in the prevention of circulatory damage Maintenance of oxygenation of the vital tissues of the body and the elimination of carbon dioxide are two of the most important factors in supporting a good internal environment, and thus maintaining circulation With oxygen want, the peripheral vascular bed may compensate for awhile, but eventually peripheral vasodilatation occurs and/or actual leakage of the plasma component into the interstitial tissues results with a further shrinkage of the peripheral circulatory volume and further potentiation of hypoxia, until eventually circulatory failure occurs from which the patient cannot be resuscitated

Carbon dioxide has its greatest danger in its tendency to produce a vasoconstriction of the peripheral circulation, thus maintaining the blood pressure and masking shock It is easier, in many instances, to recognize oxygen want than carbon dioxide excess It is only when the operation is terminated, the anesthetic equipment has been removed and the patient is placed on low oxygen, moved from the operating table and returned to his bed that one frequently realizes there has been carbon dioxide excess This

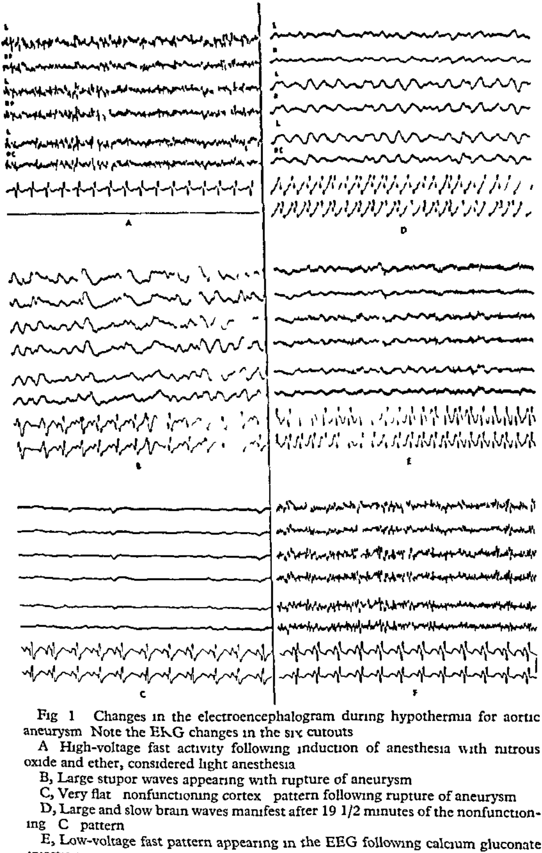

Fig 1 Changes in the electroencephalogram during hypothermia for aortic aneurysm Note the EKG changes in the six cutouts

A High-voltage fast activity following induction of anesthesia with nitrous oxide and ether, considered light anesthesia

B, Large stupor waves appearing with rupture of aneurysm

C, Very flat nonfunctioning cortex pattern following rupture of aneurysm

D, Large and slow brain waves manifest after 19 1/2 minutes of the nonfunctioning C pattern

E, Low-voltage fast pattern appearing in the EEG following calcium gluconate injection

F, Return to the high-voltage pattern in A' The EEG recording started at 6 45 A M and was terminated at 4 30 P M

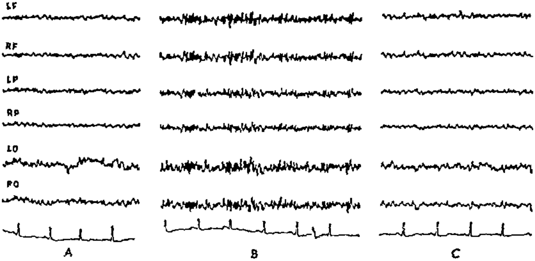

Fig 2 A, Low-voltage fast activity following induction of anesthesia with nitrous oxide for sympathectomy B, High voltage fast (25 to 35 per second) activity noted in the EEG during massaging of the sympathetic ganglion This EEG change appeared about one minute before the anesthesiologist noted a drop in the blood pressure C, Return to the previous low voltage pattern ("A') following the stimulation noted in B'

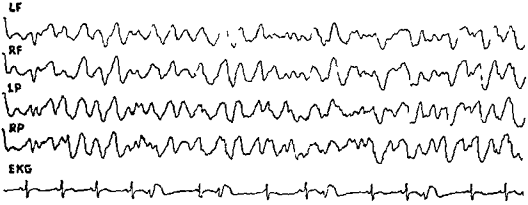

Fig 3 High voltage slow waves during ether anesthesia, considered deep anesthesia Note the change in the EKG pattern when the surgeon put traction on the stomach

excess probably occurs with the use of many anesthetic agents, but most frequently it has been associated with employment of cyclopropane, because of the tendency of cyclopropane also to slow the pulse and maintain the blood pressure and because of the high percentage of oxygen that is present as well When use of the anesthetic has been discontinued, the carbon dioxide is eliminated as well as the cyclopropane, and collapse occurs This collapse has been designated as "cyclopropane shock" It is

just as apt to occur when other anesthetics have been employed except that the other agents, since they tend to be vascular static agents, would give warning that carbon dioxide is accumulating and thus something must be done Therefore, post-anesthesia shock has not been associated with such drugs as Pentothal, even though it is quite probable that, at least with Pentothal, there is an equal or greater accumulation of carbon dioxide as there is with cyclopropane In fact, it can be stated that the deeper the Pentothal anesthesia, the greater the respiratory depression and the greater the accumulation of carbon dioxide We now know that with the open-drop ether technique, which has been considered to be so safe by many surgeons in the past, there always was an accumulation of carbon dioxide under the mask as well as a deficiency of oxygen Therefore, these patients always have a relative hypoxia or oxygen lack as well as a carbon dioxide excess It is indeed amazing to still hear that the open-drop ether technique is probably the safest Not only is this technique the most difficult, but it is probably one of the most hazardous to the patient who is seriously ill Of course, many of the hazards can be overcome by insufflating oxygen under the mask to aid in the oxygenation of the patient as well as the elimination of carbon dioxide

Position

The position of the patient is an extremely important factor in the maintenance of circulation during the operative procedure as well as in the postoperative period Studies by many of the country's leading anesthesiologists have shown that there is a marked interference with respiratory efficiency in many of the positions commonly used today in our operating room, e g , the lateral flex position or that commonly used for kidney operations, prone flex position or that frequently used for hemorrhoidal, rectal, or gynecological work, deep Trendelenburg position or that used by some for abdominoperineal and gynecological operations Not only are these positions really a poor substitute for adequate relaxation and exposure, but actually they do tremendous harm to the patient In these positions there is a tendency to accumulate carbon dioxide, and further, the upward elevation of the diaphragm frequently compresses alveoli with leakage of fluid into the alveolar spaces and, if the operation continues for any length of time, the stage is set for a thoracic complication Attempt should always be made to put as little strain on the body as possible during an operative procedure

Care should always be taken to ascertain that there is no obstruction to either the inflow or outflow of circulation to a part, and that there is no pressure upon bony prominences, lest one cause a peripheral neuritis or

set the stage for a cerebral thrombosis which can, with the passage of time, result in a vascular insufficiency or an actual pulmonary embolus

Miscellaneous Considerations

Poor relaxation, with excessive use of retractors and interference with the descent of the diaphragm, may also be a causative factor for hypoxia and hypercapnia as well as producing interference with return circulation to the heart and development of circulatory failure The longer and the more the bowel is handled, the more leakage one sees intraluminally as well as into the wall of the bowel With the concurrent development of ileus, one might expect greater interference with the circulation in the immediate postoperative course, if not during the course of the operation itself In the *hypertensive or arteriosclerotic patient, hypoxia of even a relatively short* duration may set the stage for thrombosis or embolism and the development of either a cerebrovascular or cardiovascular accident It must be pointed out that in a patient under anesthesia, if these two accidents occur, the only signs that one may see are a delay in the emergence of the patient from his anesthetic, a slight hypotension, a mild hyperpnea and/or air hunger The development of tachypnea or hyperpnea in the arteriosclerotic patient who is under anesthesia always has a serious connotation

Probably one of the most difficult problems in the operating room is the management of infusions and transfusions In general, it may be stated that blood should be used to replace blood loss and that this replacement should be concurrent with the loss Overload and an inadequate replacement are two factors to be feared Care should be taken not to administer an excess of saline solution, especially in the patient with serious cardiovascular disease These patients would best be given less than 4 gm of sodium chloride during the operative period The more serious the illness, the more one can withhold salt solution By accurate weighing of the sponges, by careful observation of the field and by careful examination of the suction bottles, one can make a very close estimate of the blood loss At the end of the procedure, correction for any errors may be made slowly after laboratory tests indicate the direction of shortage Slight overload can be tolerated if infusion is given very slowly In general, the anesthesiologist tends to overestimate the blood loss and the surgeon to underestimate it

FACTORS ALTERING CIRCULATION IMMEDIATELY *FOLLOWING SURGERY*

No patient should be removed from the operating table until it is certain that this movement will not harm him It must be remembered

that the premedication and the anesthetic agents have labilized the circulatory system, and the patient will not tolerate movement as readily as if he were awake A rapid pulse rate, that is, one above 120, air hunger, hypotension, and the like would counterindicate movement In some instances, when the position on the table is potentially harmful to the patient, the patient may be moved into a position that tends to increase the efficiency of his cardiorespiratory system This movement must be performed very carefully and slowly with adequate help Ideally, the patient should be flat on his back, in a slight head-up position if he is used to sleeping on pillows, or in a slight head-down position if increased return circulation to the heart is desirable However, it should be remembered that the Trendelenburg position tends to interfere slightly with respiration, even though it may aid return in circulation to the heart and thus increase cardiac output

Diffusion anoxia occurs in many patients in whom such agents as nitrous oxide and ethylene are used It should be realized that when this type of anesthetic agent is employed as much as 10 liters of gas may be dissolved in the body and that these gases may then diffuse out of the circulation and into the lungs for a considerable period of time, interfering with the oxygenation of the alveoli It might, therefore, be extremely helpful, in patients who have had these agents and who are in a precarious state, to add oxygen to the inspired atmosphere until the hazard of the diffusion anoxia has passed This hazard has not been given adequate attention in most institutions

It must also be remembered that the various anesthetic agents may be present in the circulating blood for relatively long periods of time, thus depressing either the myocardium or the peripheral vascular bed and the ability to compensate Probably one of the most common errors is the administration of narcotics or sedatives to a patient emerging from anesthesia who, because of pain and/or hypoxia, struggles, cries, thrashes about and is restless It would be much wiser to give oxygen and observe the patient carefully If it is felt that pain is indeed a factor, one might then administer narcotics in very small doses The average adult might be given 1/32 grain of morphine or 20 mg of Demerol, slowly intravenously When pain is a factor, one will very frequently see that this amount of narcotic, added to the anesthetic agent that still remains in the blood, will make the patient comfortable, and, in fact, in some instances the patient may go back to sleep, apparently obtaining the degree of relaxation that one would ordinarily expect from 150 mg of Demerol or perhaps 1/4 grain of morphine Too frequently the order for narcotics states that they are to be given when the patient returns to consciousness and the dosage repeated as often as required for relief of pain It cannot be overemphasized that the first and,

occasionally, the second dose of narcotics should be no more than a third of that which might be expected to be needed in the later postoperative period One can always add small amounts of narcotics when necessary Up to recently, it has been difficult to neutralize them, but now, of course, with the development of such drugs as Nalline and Lorphan Tartrate, we actually have narcotic antagonists that might be helpful when overdosage has been given

The respiration should be free and quiet without any interference from secretions, the patient's tongue, or other sources The so-called snoring respiration may be one which is 50 per cent of that of normal

During the postoperative period, one should carefully watch dressings, distention, drainage bottles, and the like Too frequently, although the blood loss has been replaced during the operation, the raw surfaces may continue to bleed for many hours after the operation and no attempt made to compensate for this loss It is not at all uncommon following a gastrectomy or a decortication or partial resection of the lung to see further blood loss which may be significant in a poor-risk patient As much as 500, 600 or even 700 cc or more of blood may be lost in the early posoperative period This blood should be replaced as it is lost

All drainage bottles should be marked as to the time they were connected to the patient and a record kept of the amount of fluid draining into these bottles Appropriate fluids should be given to replace those lost through this source The fluid lost through vomiting, diarrhea and other means should also be estimated and replacement made as the loss occurs Loss of fluid by exudate and transudate must also be taken into consideration and replacement made if the patient is to be kept in correct fluid balance The electrolytes lost should be estimated and replaced Blood volume studies are repeated at the end of the operation and checked at intervals so that adequate volume may be maintained Plasma that is lost also should be replaced, especially in patients having burns or large multiple contusions Above all else, careful, continuous, conscientious observation is indicated in the immediate postoperative period Deficits and deviations from normalcy should be corrected as quickly and as accurately as possible

SHOCK

Shock is probably the most feared of all of the postoperative complications It is an ever-present hazard in the postoperative course of every surgical patient True, the minor operative procedure, such as the incision and drainage of a small abscess on an extremity, rarely results in shock However, even in this type of surgery, syncope or neurogenic shock may occur In the young, healthy person, little treatment is necessary when

shock of this type is manifest In fact, merely placing the patient on his back, letting him breathe a little oxygen or administering a little aromatic spirits of ammonia, or even giving no treatment other than careful observation may result in a state of normality in a very few moments However, in the seriously ill patient or the patient with severe hypertension or arteriosclerotic, cardiovascular, or cerebrovascular disease, even a short period of hypotension due to a psychogenic factor may result in thrombosis which can lead to ultimate death Shock is more apt to occur in association with the more serious, more traumatic procedures in patients who are less adequately prepared than following minor operations However, all postoperative patients must be observed for the signs and symptoms of shock No surgical procedure should be carried out without an adequate observation in the postoperative period for sequelae that could have resulted from the operative intervention, whether this has been performed with the patient under general anesthesia, local anesthesia, or no anesthesia Whether or not the patient has lost blood externally makes very little difference

It has been our experience that many patients have periods of hypotension due to such minor procedures as incision and drainage, manipulation of a finger fracture, injection of a local anesthetic, or even the withdrawal of blood for a crossmatching This is to emphasize the point that all patients, regardless of the procedure to which they are subjected, must be watched for signs of postoperative shock

Definition

The term "shock" is a vague one It is applied to many obviously different conditions As examples, such designations as cardiac, spinal, hemorrhagic, anaphalactic, traumatic, toxic, adrenal and histamine shock are employed It is obvious that these various types of shock have some points in common It is also equally obvious that there are vast differences in the etiological, therapeutical and pharmacophysiological factors involved Therefore, it might be wise to give a definition of shock

Shock is a peripheral vascular failure phenomenon in which there is a disparity between the peripheral circulatory bed and the circulatory volume This state has certain contributory causes such as toxicity, neurogenic or psychogenic adverse stimuli, excess loss of blood, trauma, excess fluid loss and electrolyte loss It tends to become irreversible with an increase in the time over which it exists There are certain cardinal signs such as pallor, clamminess of the skin, evidence of vasoconstriction, both arterial and venous, hypotension, tachycardia, and altered respiration, such as air hunger, rapid or deep breathing, or shallow depressed breathing There is restlessness, evidence of cerebral dysfunction as characterized by such states

as anxiety, apathy, or even unconsciousness Thirst is a frequent concomitant Lately, it has been pointed out that pain exists in approximately one-third of the patients with extensive traumatic shock

Thus shock is, in essence, a failure of the peripheral circulation due to many causes and having many diverse symptoms and signs, none of which by themselves are pathognomonic of the state of shock, but which, combined with the proper etiological factor and clinical course, definitely point to shock

The terms "primary shock" and "secondary shock" serve little purpose and, therefore, should no longer be used Terms such as toxemic shock, traumatic shock, psychic shock and burn shock do give some indication of the state that one might expect, and therefore may serve some useful purpose However, before the term "shock" should be used in any combination, it would seem that there should be a necessity that the state have in it a degree of peripheral vascular failure which tends to become worse with the passage of time and implies more than merely peripheral vasoconstriction in a specific area of the body It should imply that there is an over-all total or bodily dysfunction rather than a vascular insufficiency in a single organ

It must, however, be pointed out that there are tissues of the body which, when deprived of adequate oxygenation, endanger the life or well-being of the individual These might be loosely called the vital tissues or organs They are brain, heart, kidneys, liver and adrenal glands When these organs show signs of vascular insufficiency, this implies, to a degree, that the compensatory mechanisms have broken down and that, as a result, even the organs which are in general protected from shock are now being exposed to an inadequacy of circulation There is a tendency on the part of the body to compensate for a deprivation to the vital organs Whereas tissues such as the skin and muscles may be deprived of circulation for an hour or more without any obvious signs of damage, this does not hold true for any of the vital structures It is not at all uncommon for tourniquets to be placed about the peripheral extremity and left there for a period of an hour or more, when these are removed, little signs of hypoxia are noted in the extremity The body can, in all probability, divert blood from other nonvital tissues and shunt them to the vital tissues at a time of stress

Compensatory Reactions to the Development of Shock

In many instances, compensation for shock occurs to such a degree that one is not even aware of the fact that a compensation is occurring In fact, it is quite probable that in most instances of trauma and stress varying degrees of compensation for the stress occur and one does not think of

utilizing the term "shock" until these compensatory mechanisms begin to break down With the occurrence of the stress, be this hemorrhage, infectious or toxic trauma, or neurologic or reflex insult, the following activity takes place

There is an activation of the pituitary adrenal mechanism with an outpouring of epinephrine or similar substances that tend to produce a rise in systolic blood pressure, as a result of the peripherovasoconstriction, as well as a tachycardia This is an attempt on the part of the heart to increase the cardiac output as well as to increase the peripheral resistance and diminish the peripheral circulatory bed With the sympathetic activity and increased output of epinephrine and epinephrine-like bodies and adrenocortical and medullary secretions, there is a quiescence of gastrointestinal tract activity and a probability of vasoconstriction of the splanchnic bed There is a concomitant hyperglycemia, and thus there is additional nutrition available for the working mechanisms of the body There is an attempt on the part of the body to shift fluids from the extracellular spaces into the vascular bed This represents an attempt to increase the circulating volume There are changes due to the glucocorticords, such as sodium mobilization, and increased renal absorption as well There is also a probability that immature red cells may be mobilized from various body depots into the circulating volume, probably the most important site being from the spleen and it is likely that some come from the bone marrow and similar depots

In addition, the liver mobilizes glycogen, fibrinogen and various other defensive substances that might be needed for the fight-flight phenomena The pulse continues to accelerate in an attempt to increase circulating minute volume There is a dilatation of the cerebral and coronary vessels as a mechanism for increasing the availability of oxygen, further constriction of the blood vessels in the nonessential portions of the body, an activation of the entire sympathetic system, and an increase in efficiency of the circulation as indicated by a slight increase in respiration, as well as a bronchodilatation Initially there may occur a rather paradoxical vasoconstriction in even some of the vital tissues, such as the kidneys and liver, and only as the state of shock progresses, with the occurrence of more trauma and worsening of the shock state, might one see the vasodilatation phenomenon, which represents an attempt to maintain the vitality of these essential organs

During this period, all that one might observe clinically is a slight pallor, a slight wetness of the skin, a tachycardia, and a slight increase in respiration rate Yet, during this period the body may be in the early stages of circulatory insufficiency and the determination of degree of actual shock that is occurring would require far more delicate instruments than are

available even in the most up-to-date laboratory It is even questionable as to whether or not the word "shock" may be applied to this early state of compensation In all probability, in clinical practice the word "shock" would not be applied until these compensatory mechanisms, which are attempting to divert blood from the nonessential to the essential areas and increase the circulating volume, as well as to increase the efficiency of the function of the vital organs, break down Only after they begin to break down does one usually apply the term "shock " However, it is in this early phase of the development of shock that relatively simple measures would be maximally effective

Progression of Shock

If these compensatory mechanisms are inadequate to meet the demands of the body and therapy is not instituted, a further progression takes place Sweating continues and the patient begins to lose quantities of fluid through the skin In addition, the vessels, which may have become hypoxic owing to the inadequacy of circulation through them, may begin to dilate, and fluids, instead of pouring into the circulation, may be lost from the lumen of the vessels back into the interstitial spaces or the extravascular compartments Severe tachycardia may actually diminish the coronary blood flow and lead to a diminished cardiac output per unit of time This results in a heart that is working under stress, and produces a much greater workload with a relative diminution in total flow, therefore, actually, in addition to the shock from a peripheral circulatory failure, relative degrees of circulatory failure due to the central mechanism or the heart itself may occur It is not at all unusual, in the patient who is in the shock state, to obtain electrocardiographic tracings that are quite typical of myocardial strain, myocardial insufficiency, or relative myocardial hypoxia

The damage to the kidneys may continue, owing to the vasoconstriction, so that the only sequela left in some patients in whom the shock is corrected a little late is definitely clinical observable damage to the kidneys and relatively little other damage It should be pointed out, however, that in all probability many other visceral tissues have been damaged as well

It is hard to tell when irreversibility occurs It should be assumed by the clinician that any patient who is being treated has not reached the state of irreversible shock, because the signs of this condition are not clearly evident However, Schour and Zweifach have postulated that, during circulatory impairment, there is a release of a vasodepressor material called "VDM " This substance further aggravates shock by inhibiting vasomotor tone and the contractility of the capillary bed The substance is one which is normally destroyed by the healthy liver tissue and probably also is

excreted in the healthy kidney in the presence of oxygen, while at the same time its effect is probably counteracted by VEM, VEM being the vasoexcitor material which is elaborated in the kidney However, if the kidney lacks oxygen, it ceases to produce the vasoexcitor substance and fails to eliminate or neutralize the vasodepressor substance The sum total of this effect is the production of a further peripheral vascular dilatation which tends to increase the disparity in the circulating volume and circulating bed, with a further worsening of the state of shock

The theory of the presence of VDM and VEM and their function in the state of shock is in a state of flux at the present time However, it serves a very useful working concept and tends to point out another reason for the urgency in the treatment of all patients having shock With the further dilatation, not only will there be an escape of fluid, but there may actually be an escape of plasma, a diminished colloidal pressure and increased inability of the blood vessels to maintain the circulating volume Blood begins to pool in the peripheral vascular bed that was originally constricted, again further depleting the body compensatory mechanisms, with a progressive down-hill trend which ultimately may end in death

Pathogenesis of Shock

There are many factors which contribute towards shock However, the three main ones are hemorrhage, tissue trauma and neurogenic disturbances This does not by any means imply that such factors as electrolyte depletion, adrenal exhaustion phenomena, toxemia, and infection do not play a major role

HEMORRHAGE The role of hemorrhage as an etiological factor in shock is easily understood It is merely a matter of the loss of vital fluid (blood) and the inability of the body to compensate by the mechanism of pouring blood from the reservoirs, which is a relatively inefficient system, and the mobilization of fluid from the tissue spaces in an attempt to maintain body homeostasis If the hemorrhage is slow and continues for quite a period of time, the body can compensate by the process of hemodilution In fact it is not at all uncommon in many postoperative patients to see evidence of the anemic and hypoproteinemic state commonly called hemodilution It occurs in many patients with concealed, slow bleeding, and in some with trauma in whom the amount of blood loss has not been excessive However, it is by no means an absolute finding in many patients in whom there has been a small blood loss, and, in fact, it even may fail to occur in patients who have severe hemorrhage It is quite probable that, in these patients, the vasoconstrictor mechanisms have played a more important role in the compensations of shock than has the hemodilution

It should be pointed out that most of the anesthetic agents and many of the preoperative analgesic agents and sedatives, such as the barbiturates and the various narcotics, have some tendency to inhibit the hemodilution factor It should also be pointed out that ether tends to cause a vasodilatation that is progressive with time and depth of anesthesia It might not be amiss to state that the plasma restoration in patients exhibiting the hemodilution phenomenon requires two weeks under normal conditions, and in the patient with a relatively severe disease, it may require a longer period of time, but that the restoration of red cells probably requires six to eight weeks or more

Neurogenic Factors It is probably true that neurogenic shock as a single entity rarely occurs in a surgical patient However, it is not at all uncommon to see a patient with a fracture, who has had relatively little loss of fluids into the tissue and little ecchymosis or blood loss, go into a state of collapse when the fragments are mobilized It is also interesting to note that the patient who is carefully and gently treated, gently moved and given very light sedation reacts in marked contrast to the patient who is moved about brusquely, whose fracture site has not been adequately splinted, or who is nervous and apprehensive The authors have seen patients who, while at rest in bed, maintain their body state for long periods of time, but who, following simple movement and the pain ensuing from the movement, go into states of shock that actually endanger their lives

Years ago, Crile, in his book, Annoci Association, pointed out the importance of the neurogenic factor Today we would probably tend to call this the stress factor There is no doubt in our minds that the more a patient is stressed, regardless of the stressing factor, the more he is apt to go into a state of shock Whether the psychic factor is a cause or effect is often not clear However, that the psyche plays an important role in at least syncope, or the so-called primary or neurogenic shock, is beyond question Certainly it would be difficult to explain the cause of syncope from other than a neurogenic basis in a patient who collapses from a venipuncture Certainly, gentleness, kindness, care and the conservative use of sedatives, as well as conservative use of analgesics in those who actually have pain, seem to have a very definite beneficial effect upon patients who have sustained traumatic injury

Tissue Damage Although damage of tissue causes a loss into the tissue areas of fluids, this loss is insufficient in itself to be the cause of shock Experimental evidence would seem to indicate that there is some substance released by this tissue damage which has a deleterious effect on the vascular integrity and on the ability of the individual to compensate for shock Experimental studies have been carried out not only on a loop of bowel

but also on peripheral tissues in which the fluid lost into the area has been more than adequately replaced In the experiments of Wolfson and Roome, extensive muscle damage was produced by a tourniquet Only when fluid replacement was combined with amputation was survival a general rule Death followed release of the tourniquet, despite amputation alone or the replacement of fluids lost in the damaged extremity Whether or not this substance released is a histamine, or whether the increased manipulation and damage to the tissue causes a release of specific toxins or furthers the probability of bacteremia is unknown However, recent studies have suggested that bacteremia may play a very real part in the facilitation of shock Certainly, the experience of the surgeon would indicate that the patients who have longer operations and more handling of tissue in general have more nausea, require more sedatives, look more sick, show the various signs of greater stress, and have a more stormy postoperative course than do patients subjected to shorter procedures involving little handling of tissue

Since tissue damage, bleeding or hemorrhage, and neurogenic stimuli are absolute concomitants to most surgery, it might be wise then to discuss what factors are important in the diagnosis and treatment of shock

Diagnosis of Shock

The diagnosis of shock rests on no single factor, sign, or symptom, but rather on a combination of many signs and symptoms which, when added together, point to the fact that there exists a state of peripheral circulatory collapse It must be remembered, however, that even peripheral circulatory failure can exist in varying degrees and for varying lengths of time, and sometimes will require no more than expectful waiting, while at others drastic intervention even to the degree of an emergency operative procedure may be required

As in all other disease states, in shock a carefully taken history and a thorough physical examination, including laboratory evaluation, are the bases upon which clinical diagnosis rests Ideally, one should look for a cause when possible, because if one finds the cause for the shock, one can treat the shock with specific rather than general therapeutic agents For example, in hemorrhage, the treatment, of course, is the transfusion of blood In shock of neurogenic cause, as may occur in association with a fracture, one might treat the shock primarily by immobilization as a specific factor and give intravenous fluids as an adjunct in the restitution of the normal vascular state Shock following a perforated viscus would require different therapy from that resulting from an overwhelming toxemia or

adrenal exhaustion Thus, the cause is extremely important in the management of shock

The shock patient should be observed continuously by someone who is managing the therapy, and, ideally, there should be an intermittent re-evaluation of the course of the patient by a consultant to the person managing the therapy, because, with continuous observation, it becomes rather difficult to notice subtle changes However, unless observation is continuous, the acute emergency requiring immediate care in shock patients cannot be met Notes should be carefully made of all therapy and of the patient's condition—mental state, thirst, cyanosis, pulse tachycardia, character of the respiration, and other manifestations If notes are not made as the various signs and symptoms occur, it becomes extremely difficult to evaluate the progression or the lack of progression of the shock state

Instruments help very little in the evaluation of the shock state It is true that certain instruments become extremely important in ruling out factors as a cause of shock, for example, the electrocardiograph as an aid in the distinction between cardiac failure and shock Frequently, laboratory tests may be of extreme aid, not so much in making the diagnosis, but rather in aiding in the evaluation of the progression or lack of progression of the shock state

As previously stated, shock is diagnosed after a sufficient number of clinical signs, symptoms and laboratory data have been evaluated In some instances this is extremely easy, in others the diagnosis of shock can only be made after a sufficient passage of time has given evidence of a progressiveness or persistence of the peripheral circulatory failure The latter is especially so when the state of collapse is relatively mild

Of importance in the diagnosis of shock are the condition of the skin, cerebral dysfunction, oliguria, thirst, pain, blood pressure, pulse and heart rate, and laboratory finds

Condition of the Skin The skin is an important structure in the diagnosis of shock in that it is one of the first tissues that is called upon to compensate in the early phases of shock In it may be seen evidence of vasoconstriction, not only of the arterial bed, but of the venous bed as well In fact, because of this vasoconstriction, it sometimes becomes exceedingly difficult to find veins for adequate intravenous therapy Usually this vasoconstriction is an early and active sign in the shock state The venous engorgement would tend to imply either an obstructive phenomenon or a central failure, rather than periphera or circulatory failure Usually the skin is wet This is due to overactivity of the sympathetic system—the system concerned in the compensation of shock The wetness may also occur as a result of excess carbon dioxide However, in carbon dioxide

excess, a pinkness rather than a pallor of the skin is noted Veins tend not to be constricted, but rather dilated The pulse tends to be full and bounding rather than feeble and rapid

Pallor is a very common finding in shock Along with this pallor, there may be, on rare occasions, evidence of stasis due to sluggishness of the peripheral circulation This is most commonly tested for by pressing on the nail bed and watching the speed of capillary refill Under normal conditions the capillary refill is almost instantaneous, but with progressive circulatory insufficiency there is a delay in the refill One should be careful, however, in utilizing this sign in areas of extreme stasis, because capillary refill time under these conditions may be rapid rather than slow This is especially true in dependent portions of the body Cyanosis is a poor sign of shock In fact, most shock patients who have lost any real quantity of blood will not show cyanosis as long as they are alive In order to have cyanosis, there must be approximately 5 gm per cent of reduced hemoglobin in the skin This would mean in the patient who had 10 gm per cent that fully half of this blood would have to be reduced to practically a zero degree of saturation Yet we know that even in a shock state the venous blood is partially oxygenated The presence of cyanosis, however, implies severe stasis or a severe degree of desaturation

CEREBRAL DYSFUNCTION It must be remembered that the body economy tends to maintain the cerebral function at the expense of most other body structures Therefore, signs of cerebral dysfunction imply a certain element of deterioration in shock states This, of course, may be a dysfunction of relatively short duration, as occurs with simple syncope, and requires little or no treatment However, when it is prolonged, it tends to be a relatively bad omen as far as the pathogenesis of shock is concerned The sensorium may show its dysfunction in many ways There may be apathy, anxiety, confusion, euphoria, nervousness, agitation, or even complete unconsciousness It should be pointed out, however, that various psychic factors as well as drugs may enter into the picture of the cerebral function One is more apt to see the confusion state if barbiturates have been used in the therapy If narcotics or depressants are used, certainly they will have their effect In general, it may be pointed out that the cerebral function may frequently be normal for long periods of time even in the face of a moderately severe degree of shock

OLIGURIA The presence of this state would imply diminished renal flow and a shunting of blood from the kidney, an important organ, to other relatively more important organs In fact, the kidney may suffer permanent damage as a result of shock with relatively little change occurring in the over-all clinical function of most of the other vital organs of the body

Oliguria becomes useful in the diagnosis only in those patients with prolonged states in whom the diagnosis of shock is either questionable or the therapy for shock inadequate

THIRST Very frequently thirst, combined with restlessness and mild tachycardia, is the early sign of shock Thirst implies an attempt on the part of the body to pull fluids from the interstitial spaces in an endeavor to compensate for the shock state Very frequently, thirst is complained of more than pain due to the injury The degree of thirst will depend to a great extent upon the adequacy of the hydration of the patient prior to the operation or accident In Dr H K Beecher's excellent monograph "Resuscitation and Anesthesia for Wounded Men," he states that men in traumatic shock complained bitterly of thirst, they much less frequently complained of pain However, in a group of fifty men severely wounded but not in shock, thirst caused considerable distress, but it was nearly always less a cause of discomfort than was the pain due to the wound

PAIN The presence of pain has very little place as an aid in the diagnosis of shock To a great degree, pain will depend upon the operative procedure or trauma that the patient has sustained, his mental attitude, his fear, the degree of depression from various drugs and many other factors too numerous to mention However, it is of note that Dr Beecher found in his study, previously mentioned, that only about one-quarter of the patients had enough pain o desire relief, even though the group had sustained traumatic war injuries In the 215 patients carefully studied, 32 per cent had no pain, approximately 25 per cent had slight pain, 18 per cent had moderate pain and 23 per cent had severe pain

One is impressed by the infrequency with which the shock patient complains of pain It may be that a certain mental adequacy is required for the patient to complain of pain Yet it would be not at all improbable that the patient who has pain and has a depression of his higher centers may be the one who tends to be rather wild, nervous or delerious, and/or agitated

BLOOD PRESSURE AND PULSE AND HEART RATE It is surprising to note the degree of dependency placed upon the blood pressure as a diagnostic factor in shock In fact, one frequently hears the statement, "This patient is in shock, his blood pressure is 80/40" (or some similar reading) While it is true that a certain minimal blood pressure is necessary for adequate functioning of the circulatory system, the authors have seen patients who have been mentally alert, who have not been in shock, who have had blood pressures that were extremely low On the other hand, one frequently sees patients who are definitely in shock who, rather than having a state of hypotension, may actually have a relative degree of hypertension and a

good pulse pressure as well While it is true that with the progression of shock the blood pressure tends to fall, placing too great a dependency of the diagnosis upon the blood pressure reading alone must be condemned The blood pressure of the patient must be viewed only as another sign to aid in the diagnosis of shock The blood pressure reading merely indicates the pressure on the lateral wall of the tested vessel, usually the brachial, and in no way can this be correlated with the adequacy of blood flow to the vital organs or even to the nonessential organs A severe degree of peripheral resistance, or vasoconstriction, may mean a markedly diminished total blood flow, and yet the blood pressure may be higher than normal

The character of the pulse is a very significant sign in the diagnosis of shock It must be remembered, however, that its greatest value lies not in its use as a pathognomonic sign, based on a single determination, but rather its employment as a gauge in the therapy and the prognosis of the condition An increasing pulse rate associated with a falling pulse pressure has a bad connotation Nevertheless, in rare instances pulse rate of around 80 is noted in patient who is in severe shock Usually, however, with the progression of shock, *there is an increasing tachycardia This represents an attempt on* the part of the body to increase the adequacy of circulation to the peripheral tissues A soft, thready pulse is certainly not an early sign of shock, but rather a late manifestation, usually present in the patient who is failing to compensate adequately

LABORATORY TESTS In general, laboratory tests are only a slight aid in the diagnosis, but they may be of some significance in a special case

The circulating blood volume is, of course, markedly decreased when the shock is due to hemorrhage In fact, it cannot be overemphasized that the newer techniques, which include tagged red cells with radioactive chromium or tagged albumin, or the combination of these two tests, may give extremely valuable information in the determination of blood replacement In the patient with long-continued shock with excessive blood loss, the utilization of information derived from these two tests may actually be lifesaving

The hematocrit determination is a helpful test Generally the value falls as shock progresses, but this is not necessarily the case The hematocrit values does fall much more rapidly than does the plasma protein level This would imply that, in many instances, the circulating blood is enriched by the addition of plasma proteins from depots

There is a tendency on the part of the body to increase the glucose level as shock progresses There is also a tendency for metabolic acidosis to occur The nonprotein nitrogen blood level also is apt to rise with the

progression of shock The van den Bergh index becomes significantly elevated as shock increases in severity and especially in duration

SUMMARY *The diagnosis is of shock is based upon careful, continuous observation of the patient with attention directed towards the skin, its circulatory responses, color, temperature and degree of wetness, the mental state, the presence of thirst, the blood pressure, the quality and rate of the pulse Laboratory findings such as blood volume and hemoglobin and hematocrit determinations may be extremely helpful It is the combination of all signs and symptoms, rather than any specific factor, that points to the diagnosis of shock By the changes in the various signs and symptoms, the urgency of therapy, the correctness or adequacy of treatment, the need for more emergent or energetic measures is determined*

Prevention of Shock

It is almost axiomatic that it is far better to prevent the occurrence of shock than it is to be able to treat it adequately Primarily, prevention of shock is accomplished in the surgical patient by adequate preparation of the patient for his operation Ramifications as to what is meant by adequate preparation are, of course, almost unlimited However, there are certain few basic points of importance

One should attempt to bring the patient's blood volume to as near a normal level as possible It must be emphasized that this should be done carefully prior to the operative procedure, lest an undue burden be thrown upon the heart and the peripheral circulatory system Correction of the blood volume should be done gradually, utilizing as much time as is permitted by the surgical state of the patient and his pathological process Sometimes speed is of importance, however, two days' lapse between the last transfusion and scheduling of an operation is preferred

One should attempt to correct the state of hydration of a patient, to bring the patient to as good a nutritive state as possible, and especially to attain a positive nitrogen balance and have the plasma protein level to as close to normal as possible The addition of a couple of pounds of actual body weight would be an excellent sign that the nutrition of the patient is being corrected This gain must represent the accumulation of body tissue rather than more adequate hydration or the accumulation of edema fluid

During the preoperative period, careful over-all evaluation of the patient must be made and such tests as are indicated should be performed However, in some instances it may actually be necessary to perform an operative procedure in order to prevent shock Classical examples of such conditions would be a saddle embolus, bifurcation of the aorta, internal hemorrhage as may sometimes occur following traumatic injuries from

bullet or knife wounds, tubal abortion, bleeding abruptio placentae, perforated bowel with a spreading peritonitis, cardiac tamponade due to a penetrating wound, thrombosis and embolism of major vessels, and many other conditions The relative urgency, of course, is variable and is dependent upon the individual case In general, however, such patients can be prepared adequately for the operative procedure One must not attempt to attain a state of normality, but rather to have a state wherein the body shows signs of being able to compensate for the insult of the operative intervention and/or the anesthesia With a good cooperative surgical team, it is indeed a rare patient who cannot be prepared adequately in a matter of a couple of hours, so that he can withstand the assault of both anesthesia and surgery We have been able to resect the aorta and replace it with a graft in patients who have come to the operating room bleeding from a rupturing aneurysm of the aorta This requires very careful preparation of the patient during the time permitted by the emergency Careful attention to fluid maintenance, especially blood replacement, and adequate oxygenation are important In many instances it may be necessary to administer oxygen during the time that the patient is being prepared Gentleness in transporting the patient and in handling him during and immediately following his operation cannot be overemphasized The depth of anesthesia and the choice of an anesthetic in many instances will determine the outcome of the procedure The relative speed with which the emergency patient is taken to the operating room is a question of judgment of the team The patient in shock should never be operated upon unless failure to operate immediately would imply a further serious progression of the shock and death Excess delay, on the other hand, is equally to be condemned

Compensated Shock

This clinical syndrome is encountered often and probably represents one of the more frequent types of shock seen in the recovery or intensive therapy units The patient has had a marked diminution in the total circulating volume, but there has been a compensation on the part of the peripheral vascular bed, so that the blood pressure is essentially normal In some instances the blood pressure may actually be higher than normal Probably one of the most important keys or guides to this state is the fact that the patient is usually pale, the skin is dry, the peripheral vascular bed is constricted, the mucosal surfaces are dry, and respiration is slightly rapid, nervousness or apprehension will largely depend upon the cause of the compensated shock The patient is called compensated because there is to a great degree an adequacy of circulation to his more vital structures How-

ever, it is termed "shock" because the body as a whole is in a state of peripheral vascular insufficiency

If this patient is handled carelessly, roughly, given large doses of narcotics or sedatives, or traumatized in any way, the state of compensation may disappear and frank shock will be manifest Even such minor stimuli as moving the patient from the bed onto the cart may precipitate frank shock When a patient with compensated shock goes into frank shock, it has been our experience that he is much more difficult to manage and requires much more energetic and rapid therapy, if one is to prevent the forward progression of the shock state, than a patient going into uncompensated shock The pulse is an extremely valuable index in the therapy for patients having compensated shock A single determination is relatively meaningless, however, serial determinations of the pulse, blood pressure and other phenomena enable one to make accurate diagnoses of the progression of the state of shock and are adequate guides to the over-all therapy

Compensated shock is seen frequently in the patient who has had a tonsillectomy and is continuously losing small quantities of blood and swallowing it It is also seen in one who has had a hemorrhoid operation in whom the bleeding is internal rather than external It is in these and similar patients that one sees an increasing pallor, an increasing tachycardia, and some of the other signs of shock, but frequently fails to diagnose the state as actual shock

Treatment of Shock

When one realizes the multiplicity of the etiological factors that can cause shock, one must inevitably come to the conclusion that there is no specific treatment It must be emphasized, however, that the most important fact to keep in mind, as stated by Drs I S Ravdin and Charles F Kirby in their paper read at the symposium on shock at the Army Medical Service Graduate School, is that when shock does occur during an operation, it is nearly always due to neglect of preventive measures which are now well established and should have been instituted Yet, in a rare instance, in spite of preventive measures, shock will occur because of factors beyond the control of the surgeon and his team

The etiological factors of shock are so manifold that it is immediately obvious that treatment must of necessity be varied In general it can be stated that in shock therapy, as in all therapy, treatment must be specific when at all possible However, there are so many contributing factors that the specificity of the treatment may be well nigh impossible in many instances Contributing to shock may be such factors as cardiac decompensa-

tion, extensive infection, trauma, hepatic insufficiency, chronic debilitating illness, metabolic disturbances, age, hepatorenal disease, vascular disease, anoxia, hypercapnia and excess reflex activity Therefore the patient must be very carefully examined and a diagnosis made of the cause of shock, as well as appraisal of such factors as the state of the circulation, the degree, duration and severity of shock, whether or not hemodilution or hemoconcentration has occurred, whether or not there is peripheral pooling, and the degree of urgency

Speed is an essence in all shock therapy Although it is to be questioned when the irreversible state of shock occurs, there can be little doubt that, as shock progresses, more damage is done to all tissues of the body and restitution of normality to the patient as a whole becomes exceedingly difficult Correct therapy would imply the judicious use of blood, plasma, plasma expanders, crystalloids and fluids, oxygen, sedation and such other adjuncts as may be indicated in a specific case In certain instances, when contributing causes can be diagnosed, treatment should be directed toward rectification of these causes as well as toward replacement of the various blood elements that have been lost Sometimes, if the tissue anoxia or hypercapnia, metabolic acidosis, toxemia, adrenal exhaustion or hypoadrenalism, electrolyte imbalance, and the like, are not treated, coincident with the administration of blood, the blood replacement may be to no avail

At times it may be merely necessary to restitute a state of emergence from the shock state as the patient is prepared for immediate operative intervention In these patients for whom operative intervention is planned, the practical consideration as to the total amount of blood available, as well as the disease entity, may force one merely to restitute a state of circulation which is compatible with operative intervention It is believed, at the present time, that in patients such as those bleeding from a gastric ulcer or similar condition, a restitution of normal blood pressure will not cause a significant increase in the amount of bleeding In general, if the pulse pressure record tends to show improvement, the blood pressure chart indicates a near normal state, and the clinical condition shows a tendency of emergence from the state of shock, as soon as adequate blood is available for replacement during the operative procedure, the patient can be carefully, gently and slowly moved to the operating room and the lifesaving procedure carried out No patient, of course, should be operated upon while in a state of severe or increasing shock With the infusion systems and blood bank facilities that are now available in most hospitals, more blood can easily be placed in almost every patient than is lost from a wound site

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existed a hemodilution in the presence of an adequate or overadequate hydration, the packed cells become an excellent means of aiding in the treatment of shock

The use of compatible blood probably represents the therapy for more than 95 per cent of the patients who develop shock in the postoperative period It is becoming increasingly clear that in general the surgical team tends to underestimate the amount of blood lost The estimation of bleeding is notoriously inaccurate If special precautions are taken, such as weighing the sponges and careful estimation of blood in the suction bottles as well as that which contaminates the surgical field, a fairly close estimation of the blood lost will be obtained With the passage of time in the long, tedious operations, there is a tendency toward greater and greater percentages of errors This is especially true in those patients who have acute major blood loss or continuous oozing such as occurs in conjunction with so many extensive evisceration-type procedures Ideally, blood loss should be estimated continuously and replacement kept parallel to the loss If the records of institutions in which large numbers of operations are performed are examined, it is indeed rare to find many patients in whom extensive transfusions have caused overload phenomena It is not at all an infrequent occurrence to find evidence, upon re-examination of the patient in the recovery room, that another unit or two of blood will help considerably in the postoperative course It is hoped that the time will soon come when every patient having a major operation will have, as a part of the routine "work-up," a blood volume determination Even though it is well known that the figures for normal blood volume vary tremendously, by the use of the radioactive tagged chromium and tagged albumin, one can make serial determinations of the blood volume and have a report in half an hour for use as an aid in the guide to therapy of the postoperative patient Indeed, in some instances, the blood volume determination may be one of the most important guides to therapy The use of the dye techniques is helpful, however, these procedures do not have as great an over-all value in the serial determination of blood volume as do the previously mentioned tests This in no way implies that one cannot adequately manage the patient without these laboratory data, but, if available, they become extremely useful instruments in aiding the over-all clinical judgment

PLASMA SUBSTITUTES OR EXPANDERS Blalock, in his original monograph on shock, cited evidence that indicated that there is a wide margin of safety in oxygen-carrying capacity of blood and that the primary objective in the treatment of shock is the restoration of the circulating volume rather than the restoration of the hemoglobin It is known that if the colloidal osmotic pressure of the blood is not adequately maintained, there is an

However, it must be pointed out that the anesthetic for patients of this type must be of such nature that it will not increase the shock state No agent should be utilized that will cause a hypoxic state or a peripheral vasodilatation or produce strain upon the cardiovascular mechanism In the hands of the skilled anesthesiologist, regional anesthesia is preferred, however, inadequate use of this anesthesia or an inadequacy of the technique to fulfill the surgeon's requirements would contraindicate its use Careful administration of such agents as cyclopropane-oxygen, with the use of the muscle relaxants such as Flaxedil and succinylcholine, enables the skilled anesthesiologist to give the surgeon ideal working conditions in a patient who is in an extreme state of vasoconstriction or compensation for shock It is not at all uncommon, once anesthesia has been stabilized and blood and fluids are being used judiciously, to see the patient markedly improve while under the anesthetic However, this requires team effort in the attack on the surgical disease, with each physician contributing his *portion to the over-all management of the patient*

Blood Replacement In general the most important cause of shock in the postoperative patient is blood loss There is at this time no adequate treatment for blood loss except its adequate replacement by compatible blood obtained from a human being Although the plasma substitutes, or the so-called plasma expanders, may increase the efficiency of that blood which is still present in the patient and actually aid in preventing the forward progression of the state, they do only what their name implies In general, when blood has been lost into a body cavity, into the tissues, or externally, this blood should be replaced

It is unfortunate that there is no golden rule as to the amount of blood to be given a specific patient However, it should be pointed out that shock rarely manifests itself until approximately one-quarter of the total circulating volume of blood has been lost It therefore becomes obvious that therapy can be started by giving one or two units and the response of the patient watched Appraisal of the response is based upon such factors as the over-all clinical reaction, as discussed in the diagnosis of shock, the blood count, the hematocrit and hemoglobin determinations, and when at all possible, blood volume studies The laboratory studies, although often of secondary importance, may become of primary importance in the determination of therapy When it is found that such a state as hemodilution has occurred, blood loss can be speedily replaced with impunity If there is danger of overload, this is prevented by the simple and efficient technique of drawing off the plasma from several units of blood and giving this cell suspension to the patient In the acute emergency, however, this is rarely necessary In some patients whose disease state is such that there already

an ever-present hazard However, with the institution of Dr Garrott Allen's new technique for the storage of plasma at room temperature over a period of many months, there appears to be a gradual diminution in the number of reactions to plasma due to the viral diseases

The judicious use of plasma in patients in shock states wherein hemoconcentration is in evidence appears logical This agent would seem to have its greatest usefulness in persons having trauma of the type in which serum or plasma is lost into the body tissues with very little loss in blood cells It might also be used in combination with blood in those patients in whom rare types of blood are necessary for the treatment of shock In these patients the combined use of blood and plasma could more economically maintain a better and more efficient homeostatic mechanism

The use of plasma in the burn patient is of tremendous importance Although whole blood is extremely important in the over-all management, care might be taken that a normal or near normal state be maintained relative to blood and plasma However, plasma is so important in the burn patient that the following general rules have been worked out Two units of plasma may be used in the first twenty-four hours for each 10 per cent of the body surface that is burned Or 100 cc of plasma may be used for each point above 45 of the hematocrit reading and this amount may be increased as much as 25 per cent for every gram of proteins below 6 per 100 cc These are merely "rules of thumb" indicating the need for plasma in the burn patient However, this problem is more completely discussed by Dr Stokes in Chapter 15

In his book, "Resuscitation and Anesthesia for Wounded Men," Dr Beecher and his co-workers drew the following conclusions relative to plasma

1 Plasma gives more time to get whole blood into the patient

2 The patient who has been in poor condition because of blood loss with low blood volume and probably with a low hematocrit level will often be seriously endangered if his blood and effective vascular volume are increased by plasma without hemoglobin being added

3 Plasma alone will not adequately prepare the seriously wounded man who has lost blood for surgery

Thus, in essence, plasma is an excellent agent in aiding in the maintenance of blood pressure in those patients who have an adequate red cell volume or as a temporary expedient for the maintenance of circulation until blood can be made available

Since most authors will agree that plasma is probably the best of the intravenous preparations that can be utilized as a temporary expedient

acceleration of the loss of fluids into the body tissues with a diminution in circulating volume and a further potentiation of shock

The plasma expanders are drugs which are capable, as their name implies, of expanding the plasma fraction of the circulating blood The name "plasma substitutes" is probably preferable because these elements do not completely or totally replace the plasma, at least from the nutritional and anti-stress standpoint Although, in the average civilian practice, the plasma expanders are not used to a great degree, they are valuable adjuncts in emergency therapy Their primary function is that of a temporary expedient, while plasma or blood therapy or the necessary specific corrections are being carried out These various agents each have their own inherent characteristics, however, they are all micro-molecular colloids which, therefore, penetrate the living membrane only with difficulty They are prepared, in general, by synthesis or degradation and are always mixtures of various-sized molecules They tend to have the same colloidal osmotic pressure as plasma They also tend to be lost chiefly by filtration into the various visceral structures, renal loss by filtration is the chief pathway for the early removal of most of the expanders The smaller the molecule of the various expanders, the more rapidly is the expander lost from the circulation The larger molecules tend to be filtered out after a period of time in the various capillary beds Although their exact mechanism of action is not understood, hemodilution due to the agents is a constant finding and is reflected in a decrease of the hematocrit, as well as total protein, concentration A change in the total protein may to a great degree depend upon the protein stores or depots and it is suggested that the micro-molecular substances start a cycle of autotransfusion of the body's plasma proteins In general, they all maintain a satisfactory colloidal pressure They should be relatively stable and economical to use, they should have a viscosity resembling that of plasma, their storage should require no important equipment other than that usually available, they should be pyrogen free and nonantigenic and should of themselves cause no damage to the visceral function

Of all of the plasma expanders, certainly the most physiological is plasma itself This blood product serves not only as an expander of the fluid compartment with all of the usual physiological functions of plasma, such as the retention of water, the action of plasma in body metabolism and energy, and the active role of plasma in the defense against infection, but in numerous other metabolic functions that are primarily not concerned with the problem of shock However, plasma has a distinct disadvantage in that the supply is naturally quite limited, the cost is a definite factor, and the possibility of allergic reaction as well as the transmission of disease is

The early preparations of oxypolygelatin were nephrotoxic However, in recent studies on human beings made by Higgins, it was found that the recent preparations of the oxypolygelatin do not produce proteinuria in human beings, although they apparently still do so in rabbits

Dextran This product is a complex polysaccharide prepared by the action of *Leuconostoc mesenteroides* on some form of sugar slime Its molecule is composed of glucose units that are joined in branch chains of different glucositic linkages The native crude dextran is extremely toxic, but after acid hydrolysis to a suitable molecular weight range, it is made safe for intravenous injection It is usually prepared in a 6 per cent solution in physiological saline solution This preparation usually has a molecular weight that is very close to that of plasma, although the molecular weight for the Swedish product is about 34,000, for the American product, 11,000, and for the English product, about 73,000, with a scatter of molecular weight dependent upon the process of manufacture Some of the original products had concomitant allergic-type reactions, such as asthma, skin manifestations, joint pain, itching and urticaria, headache, vasomotor collapse and respiratory distress This has not been seen with any frequency in some of the newer preparations that have now been made available This does not mean that reactions do not occur, but rather that their incidence is now markedly diminished

Dextran is a good agent for restoring the circulating volume, maintaining the blood pressure and promoting survival of the individual in shock. There is a tendency on the part of dextran, however, to increase the aggregation of erythrocytes so as to make typing a little more difficult than is normal and increase the difficulty of crossmatching blood, therefore, when this agent is used, it is wise to draw blood for the crossmatching in adequate quantity prior to the administration of the dextran Although several authors have reported that, on histological study of tissues of patients as well as animals who have received dextran, there has been evidence to indicate that the dextran remains in viscera such as liver and kidneys In general there has been agreement that there has been no evidence of dysfunction caused by this retention of dextran Almost all of the research workers agree that dextran infusion results in a significantly greater hemodilution and a more rapid recovery of blood pressure than does plasma infusion However, both substances result in adequate recovery and maintenance of blood pressure The acidosis of shock, on the other hand, seems to be more rapidly corrected when plasma is used than when dextran is employed The regeneration of hemoglobin and red cells is not adversely affected by dextran or plasma infusions The rate of regeneration of the plasma proteins is not markedly affected and seems to occur at a rate consistent with the dis-

until blood or other specific therapy may be instituted, there has been a desire on the part of the clinician to have always available for the emergency patient a product such as plasma which may be utilized while the blood is being drawn, typed, or made available Various plasma expanders or substitutes are now obtainable for administration These include gelatin, oxypolygelatin, dextran, polyvinyl pyrrolidone albumin, and similar substances Of these the most popular at this time seems to be dextran, polyvinyl pyrrolidone, gelatin and oxypolygelatin Acacia in a 6 per cent solution was used and studied by various authors, however, at this time, because of unavailability, reactions of an allergic nature, and the potential pathological effect upon the liver, this product is less popular than it was originally However, it is possible that, with further studies and the availability of a purer and more uniform solution, or different fraction, it may again come into popularity

Gelatin With use of the original preparations a large number of reactions due to the gelatin occurred These reactions may have been caused by the transfer of bacteria in the product as well as by the antigenic properties of the preparation Newer preparations of gelatin, especially a gelatin called "fluid gelatin," prepared by the Knox Company, show a marked improvement over the older products In general, the various gelatin products, now made available by different companies, have varying molecular weights and varying states of viscosity and jelling points They have been found to be superior to saline solution and roughly equivalent to plasma for the restoration of blood pressure and blood volume in the maintenance of life in experimental animals that have had hemorrhagic, traumatic and tourniquet-type shock However, whether or not gelatin solution is superior to saline solution in the treatment of burn shock is still in a state of controversy It is also controversial as to whether or not gelatin is metabolized In regard to any histological changes that might be produced by the gelatin, a large percentage of the writers on the subject claim that these products do not damage the visceral tissue There seems to be a feeling also that they do tend as a group to diminish the production of plasma proteins on the part of the body

Oxypolygelatin This product jells only at temperatures below 18° C This gives it a distinct advantage over many of the gelatin products In normal man, Higgins found that there was 19 per cent retention of the infused dose of the oxypolygelatin at the end of the infusion and 75 per cent was still present at the end of four hours In general, most authors feel that half of the administered oxypolygelatin is present in the circulation for about five hours following infusion and about 32 per cent at the end of twenty-four hours

by pulling water or aiding in the hemodilution of blood, it must be remembered that the blood pressure should not be restored to normality with them, but rather there should result from their use a drifting tendency toward normality in that, as time progresses, fluids may be pulled into the vascular bed to the end that overload phenomena can and have occurred with their use In addition, it must be remembered that they are in general plasma substitutes—they do not substitute for blood They can aid the efficiency of circulating blood or stagnant blood, but in themselves they do not carry oxygen to any significant degree There is suggestive data now accumulating that these products may have the ability of absorbing to their surface elements necessary to the formation of clots, and if large quantities are employed, interference with the clotting mechanism of the blood may result It is probable that the factor responsible is the adsorption of prothrombin or fibrinogen to the surface of the molecule It is also probable that this will not be clinically manifest until a volume of plasma expander that represents something in the excess of 700 to 800 cc has been employed With use of volumes up to this amount, the probability that serious or significant damage will be done is not likely If these agents have been administered and the circulating volume has been restituted to normality, it might be wise, when correction for the actual blood loss has been made, to keep in mind that there might be a definite advantage in the administration of packed cells as compared to the administration of whole blood

In spite of all of the advantages and disadvantages, in essence plasma substitutes or expanders are temporary expedients for the maintenance of circulation and the prevention of the forward progression of shock until such time as more definitive therapy can be carried out They become extremely valuable when blood loss has been severe and one does not have at hand plasma or blood for the replacement In these instances, the plasma expanders may be administered so as to maintain a state of near normality until suitable substitutes can be utilized

VASOPRESSORS As previously stated, shock is a state wherein there is a peripheral vascular failure In many states of shock, there occur, as part of the syndrome, peripheral stagnation and pooling, refractoriness of the vessels to endogenous norepinephrine, a progressive leakage of fluid out of the vessels, and a tendency toward irreversibility There can be little doubt that the vasopressors such as levarterenol bitartrate, commonly known by the trade name Levophed, and phenylephrine, commonly known as Neo-synephrine, are effective vasoconstrictors Although vasoconstriction is frequently present in many shock states, this vasoconstriction may be ineffectual in the maintenance of circulation to such vital tissues as the brain and the heart Although isolated experiments might make one doubt the

appearance of the dextran Although some individuals feel that dextran is definitely metabolized, this metabolism offers little in the way of nutrition

In essence then, it might be stated that dextran is a good plasma expander which rapidly and efficiently increases the total circulation of blood by increasing the plasma fraction It has some disadvantages as far as blood typing is concerned, the speed with which the fluid compartment is expanded is good, the maintenance of blood pressure permits adequate time for the institution of more definite or specific therapy In some patients, of course, in whom hemoconcentration is a definite factor and the primary factor is the loss of the fluid compartment, dextran infusion may be all that will be needed The substance serves as an excellent substitute for plasma in most patients suffering shock of the hemoconcentration type These conclusions parallel those of Dr Pirani and his co-workers in their study on the use of dextran in hemorrhagic shock

Polyvinyl Pyrrolidone (PVP) This synthetic water-soluble polymer is used as an expander It is prepared from the reaction between acetylene, ammonia and formaldehyde under pressure It also has varying manufacturing processes, resulting in different viscosities as well as different molecular weights Essentially, it resembles dextran in its efficiency However, because of its greater storage phenomena in man and animal, there has been a fear on the part of many that there would eventually occur damage to visceral cells, although in general the amount of damage demonstrated as a result of this product has not been significant It differs in one respect from dextran in that it can chemically combine certain molecules, such as those of dyes and bilirubin, and thereby aid or affect their renal excretion It may even be able to bind such things as toxins or viruses This product has enjoyed the same popularity in Europe as dextran does in this country In general, its over-all efficiency is the same as that of dextran, the variation depending upon the different techniques of manufacture and the molecular weights of the various products used

Albumin Albumin is another plasma volume expander which, on the theoretical basis, should have a greater efficiency than plasma, since the albumin represents approximately 80 per cent of the colloidal osmotic pressure exerted in the human body Its advantage is that of its small bulk for storage and its stability, however, the disadvantages are those of allergic sensitization, the relative expensiveness of the product and the difficulty with regard to obtaining it Even though one would have expected a much greater efficiency from albumin than plasma, in general this product is very similar in its efficiency to plasma, and has relatively little significant advantage when compared to plasma

Conclusion Since all the plasma substitutes or expanders act chiefly

The authors have observed a slough resulting from the diffusion of the Levophed solution into the tissues Whether such a lesion is caused by the solution leaking along the vein or by direct diffusion through the vessel is not known at this time It might be wiser to use an arm vein rather than leg vein, because relatively few, if any, of these slough reactions to Levophed have occurred when an arm vein has been used With the use of Neo-synephrine, sloughing has not been reported

In general the vasopressor solutions may be employed interchangeably, certainly the potency of Levophed as far as the pressor response is concerned is much greater than that of Neosynephrine Other similarly acting vasopressors may be used in place of either of these drugs when desired The rate of administration at the beginning must be extremely slow—probably no more than 1 drop should be given every five to ten seconds—and gradually adjusted to the demands of the patient Since vasoconstriction is indeed not a physiological state, every attempt should be made to slow down the administration of the vasopressor, if its use is not discontinued, as soon as the patient's clinical condition warrants this

The standard routes of administration are to be condemned One does not know what a particular patient will require and the rate of administration will depend upon the fluctuating state of the patient No patient receiving intravenous vasopressors should be left alone and there must be a blood pressure cuff on the patient's arm at all times The blood pressure should be taken every ten minutes at the very minimum With each change in the rate of administration or concentration, a careful re-evaluation of the blood pressure must be made at regular intervals of about every minute or two until the maximum effect of the drug has been reached

On numerous occasions, the authors have kept patients, who have failed to maintain adequate circulation, on this therapy over a period of several days, and have felt that, without this therapy, they would not have been able to maintain life It cannot be overemphasized, however, that an adequacy of blood pressure does not mean an adequacy of circulation The vasopressors are merely crutches of a temporary nature which are capable of maintaining the vitality or the circulation to vital structures, primarily the coronary arteries and the brain and probably the adrenal glands, while investigative and supportive therapy and other appropriate measures are being carried out, with the plan of discontinuing vasopressor therapy as soon as possible However, it can also be stated that the continuous use of intravenous infusions of blood and plasma in a patient who is not responding to their administration, in spite of adequate volume, is equally foolhardy Patients who have had sustained use of vasopressors must be weaned gradually with diminishing concentrations and rates of flow

efficiency of these vasopressors, there can be little question that they are effective in increasing the blood pressure and reversing many of the more important signs of shock, as well as in improving the over-all shock state of the patient In many instances, even though adequate quantities of blood and also of fluids of the correct type have been administered to the patient, one finds that the patient does not respond This is especially true in such patients as those having a sympathectomy or removal of a pheochromocytoma, those with severe myocardial infarctions or septicemia, or following the administration of certain drugs producing vasodilatation, such as hexamethonium, procaine, or procaine amide In these patients there can be no doubt but that the vasopressors are a specific in the termination of shock if properly used with adjunctive therapy

Since the vasopressors are short-acting, have a high safety ratio and do not give unexpected side reactions, they can be titrated into the patient to the response desired and their action terminated almost at will Therefore, with correct use of these agents, the duration and severity of action can be controlled However, it must be pointed out that they are not substitutes for blood, plasma, or fluids, but rather are they an adjunct to these agents The vasopressors may be considered as a temporary crutch while other more specific therapy is being given or preparation is being made for the institution of such therapy It is our belief that it is preferable to take the risk of using a vasopressor than to face the hazard of an extremely low blood pressure, especially when this blood pressure, with or without tachycardia, is associated with definite signs of severe shock

Ideally the vasopressors should be given in saline solution containing 5 per cent dextrose or in distilled water containing 5 per cent dextrose, depending upon the body needs of the patient They should not be mixed with whole blood or plasma because of the attending difficulty of adjusting the rate of administration In most instances, 4 cc of the Levophed bitartrate solution, which is a 0 2 per cent solution, are added to 1000 cc of the 5 per cent dextrose solution A Neosynephrine drip or infusion may be prepared by the addition of 1 or 2 cc of the 1 per cent solution to a liter of fluid The concentration of these stock solutions will depend to a great degree on the need of the patient and the desirability or the lack of desirability of the administration of fluid When fluid administration is of advantage, the more dilute solution more rapidly administered is to be preferred When overhydration is a problem, the solution may be made two, three, four, or even five times the concentration recommended without fear of damage It is to be preferred that when these intravenous vasopressors are used, a polyethylene catheter be employed rather than a needle and that this catheter be threaded well into the vein and carefully placed

been corrected in so far as is possible, and other adjunctive therapy has been given, and it is felt that there is some reason for an inadequate response on the part of the pituitary adrenal mechanisms, then ACTH or cortisone may be used Their use would be most apt to be indicated in patients with long-standing septicemia and in those with bacteremia whose history would suggest adrenocortical exhaustion

The authors themselves have utilized this therapy in several instances, with rather dramatic results In one patient the blood pressure seemed to respond rather dramatically to the administration of a hydrocortisone product

Although ACTH and cortisone probably have little value in the normal healthy individual, in those suspected of having inadequate amounts of these substances, careful and judicious use may prove of benefit Time alone will answer the question of the place of ACTH and cortisone in therapy for the shock patient At present there seems to be too much enthusiasm for or against their use, with an inadequacy of carefully controlled data

Oxygen There can be relatively little argument against the fact that hypoxia is a definite and real potentiality in most shock patients Even though the amount of exchange is adequate, there is evidence that there is a tissue hypoxia on the basis of inadequacy of circulation It is quite probable that the forward progression of shock might be diminished very definitely with good oxygen therapy In fact, as one considers the signs and symptoms of shock, one notices a very high correlation between these signs and the signs occurring with tissue hypoxia The exact mechanism in oxygen therapy of the shock patient would be that of greater saturation of the blood and greater saturation of the plasma compartment, thus making more easily available to tissues this vital gas Ideally, the oxygen should be given to patients of this group at a tension of above 50 per cent and the administration continued as long as signs of shock exist Use of the BLB and OEM masks would seem to be the best technique for giving oxygen to the shock patient

Sedatives and Narcotics There should be definite indications for the use of sedatives and narcotics in the shock patient These drugs diminish the ability of the body to compensate As a group they tend to depress respiration as well as diminish the compensation of the homeostatic mechanism However, their careful and judicious employment, when truly indicated, might be of real benefit Although the amount of pain complained of by the average shock patient is usually relatively small, in those in whom pain is definite and severe, the various narcotic drugs might be utilized However, these agents should not be given subcutaneously or intramuscu-

ACTH AND CORTISONE It is now generally agreed that the reaction to stress on the part of the adrenal glands can be integrated into two anatomical and physiological parts

The autonomic nervous system was found to respond to the alarm by stimulating the adrenal medulla through the splanchnic nerves to secrete epinephrine This is the immediate and rapid phase of reaction to stress The duration of its action is dependent to a great degree upon the type and severity of the stress In addition, epinephrine was discovered to stimulate an increase in the output of hormones to the cortex as well The increased cortical output proved to be mediated indirectly through ACTH release from the anterior pituitary gland Thus the quick-acting epinephrine and intermediate endocrine response to alarm soon finds support in a secondary defense in the slower and longer-acting cortical hormones There is also evidence that the higher centers of the brain may directly stimulate the anterior pituitary gland to release its ACTH

With the advent of the powerful hormones, ACTH and cortisone, there have been those who have strongly recommended their usage in shock The rationale for this is based on some of the established or generally accepted concepts That there is an increased output of the adrenocorticotrophic and corticoid hormones on the part of the normal individual in response to trauma, that these adrenal hormones do have something to do with the maintenance of blood pressure, and that the addisonian-type patients need some form of cortisone therapy when traumatized to stress are positive findings However, there are also equally positive findings that the adrenocortical hormones cannot make blood constituents fast enough to offset hemorrhage from traumatic wounds or plasma loss from burns They cannot, in other words, compensate adequately alone They must have help in the form of water, blood, electrolytes, and the like

It is equally definite that there are potentialities of harm from ACTH and cortisone therapy (1) the possibility of excess potassium with the kidneys not functioning, (2) diminution of the anti-inflammatory process, as evidenced in certain burn patients and by the development of peptic ulcer

There is a possibility that ACTH and cortisone may suppress the function of other endocrine systems which may play a vital role in combating shock The danger in ACTH and cortisone therapy is not so much that it will do harm, but possibly that more important therapy, such as the administration of blood, fluids, plasma, and electrolytes, may be inadequately used in favor of the "magic bullets" It would seem that in the rare instance in which the patient has failed to respond, when the urinary output is adequate, the circulating blood volume and blood cell deficits have

been corrected in so far as is possible, and other adjunctive therapy has been given, and it is felt that there is some reason for an inadequate response on the part of the pituitary adrenal mechanisms, then ACTH or cortisone may be used Their use would be most apt to be indicated in patients with long-standing septicemia and in those with bacteremia whose history would suggest adrenocortical exhaustion

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larly, but rather intravenously The dosage should be extremely small As a working rule, one might employ one-quarter to one-third of the dose that one would use for a patient who was not in shock Ideally the narcotic should be given over a period of a couple of minutes in a carefully diluted solution so that the entire amount will not quickly act at one time When doubt exists, the total dose, for example, 1/24 to 1/12 grain of morphine, might be given in three separate fractions at ten-minute intervals There can be little doubt that the very fact that something is injected into the tubing may have a very definite and real beneficial effect upon the patient even though this injection contained nothing more potent than a few cubic centimeters of normal saline solution Morphine used intramuscularly or subcutaneously may not be absorbed in a shock patient and, when repeated dosages are administered, there is a hazard that all of the drug will be absorbed at approximately the same time if improvement occurs, with a deleterious effect With routes other than the intravenous route, it becomes extremely difficult to judge the adequacy of the effect of the dose administered Maximum analgesia by the intravenous route will usually be present within a ten-minute period and the maximum depression of the patient should become apparent within a fifteen-minute period

Ideally, one might add to the effect of the narcotic or analgesic drug by giving a small amount of a sedative, such as one of the barbiturates, as well Since fear is probably a real part of the complex commonly called shock, in those in whom it is present, a careful, kind, sedating attitude on the part of the physician may have an effect equal to that of many of the drugs Yet, in some specific instances, the barbiturates may be employed The minimal dosage should be administered by the intravenous route, a careful estimate of the effect being made prior to giving the total expected dosage It should be pointed out that the duration and the severity of the effect of sedatives might be expected to be much greater than is normal, since the process of elimination and/or destruction and detoxification in all probability is markedly depressed in patients in the state of shock A confusing element in the use of the sedatives in shock patients is the fact that the sensorium of many of these patients varies tremendously, depending upon such factors as the degree of shock, severity and type of injury, and the psychic make-up of the individual It should be pointed out that restlessness, nervousness, anxiety, and the like are signs of shock which, in many instances, will disappear as compensation takes place and, eventually, treatment is successful

The narcotics and sedatives should not be used as primary therapy, but rather as adjunctive therapy in the management of shock

ORAL FEEDING Certainly, solid food would seem to have little place

in the management of the shock patient In fact, its use should be condemned The presence of thirst might tempt one to utilize the oral route for the administration of fluids Small chips of ice or a swallow or two of water may do little harm However, larger quantities of fluids may well initiate nausea and vomiting and thus potentiate the shock state Also, it is to be questioned as to what degree the fluid administered orally will be absorbed during a true shock state Certainly the oral route cannot be depended upon to give the patient adequate hydration However, if the patient can be made more comfortable by giving him a sip or two of water, with a small amount of salt added, or such liquids as tea or coffee, this small amount may do little harm and actually might be over-all, as well as of psychic, benefit

ANTIBIOTICS There can be little doubt but what severe toxic or infectious states frequently have as a concomitant a shock-like state The acute infections which may be responsible include those produced by the clostridia, the hemolytic streptococcus, the hemolytic staphylococcus, pneumococci, intracellular cocci, gram-negative bacilli and a mixed bacterial flora There are many ways in which these organisms, when they occur in sufficient number to cause a definite infection, might cause circulatory collapse The reaction may be a result of a histamine or protein degradation product, of the toxins on the capillary wall or upon the myocardium, of the local or continued effect of hypoxia, of the direct action of the organisms or their toxins upon the vessel wall, or of numerous other factors Whether or not the overwhelming infection causes a Waterhouse-Friderichsen type of syndrome or whether it produces an actual adrenocortical insufficiency or relative state of insufficiency is not known However, evidence of adrenocortical exhaustion has been found in patients dying in various states of infection If the traumatic injury or the operative procedure has been in the area of the bowel or the liver, there is quite a possibility that some of the organisms, such as those of the Clostridium group which may be normal inhabitants of the liver, may be released into the systemic circulation Also the role of *Escherichia coli* in injury in and about the buttocks or gastrointestinal tract is not clear at the present time It would seem that in many instances an antibiotic might well be used as a secondary factor in aiding the control of shock

To a patient in a state of shock, it would seem preferable to give antibiotics that can be administered intravenously rather than those which must be given intramuscularly, even though the latter have given a fairly definite blood level in experimental animals in which experimental shock has been produced If at all possible, blood should be drawn for culture prior to the institution of antibiotic therapy, because, if at a later date the

patient seems to be resistant to over-all therapy, the information thus obtained might be useful even though the shock-like state has in all probability been controlled

The antibiotics are not primary factors in the control of the usual surgical shock, however, they may be extremely important in the treatment of shock that develops in the first few postoperative days

HEAT THERAPY There is a definite tendency at the present time to utilize as little bed covering as possible for the patient, the patient thereby being exposed to room air, permitting actual body cooling Recognition of the benefits gained from the use of the hypothermic technique during surgical stress is making this therapy increasingly popular Certainly the use of hot water bottles or heavy blankets has grown increasingly less frequent, and there would seem to be no indication at present for their employment in shock therapy It is questionable whether one should actually utilize cold or cooling agents to produce a lowered body temperature in the shock patient Although hypothermia is being used extensively in the treatment of the acutely shocked and toxemic patient in many of the European clinics, it has not received acceptance in this country, even though there would seem to be a plausible physiological reason for the utilization of the technique

VASODILATING AGENTS There is a flood of articles appearing from the European clinics on the utilization of vasodilating, tranquilizing, antihypertensive, anti-stress drugs in the treatment of shock Although experimental studies have shown that many drugs such as Thorazine or Chlorpromazine can protect against traumatic and hemorrhagic shock in the experimental animal, this treatment has not to date been used under controlled conditions in an adequate number of the human beings to arrive at a definite conclusion as to its real place in shock therapy Certainly, some of the reports would seem to indicate almost miraculous results, but the lack of adequate control would make one cautious of the acceptance of the treatment at this time

CARDIAC GLUCOSIDES Many articles have appeared in the literature on the use of drugs such as ouabain, strophanthin and many of the rapid-acting digitalis preparations Experimental studies would tend to make one feel that these drugs have relatively little place in the management of shock in the patient who has a normal myocardium In the patient who has incipient failure and has not been given any of the digitalis or cardiac stimulant-type drugs, these rapid-acting, intravenous preparations might, in the rare case, have a real and definite place It is the authors' personal opinion that one should really make a tentative diagnosis of a failing myocardium before employing them

On three occasions the authors have seen patients who failed to respond to fluids, blood and vasopressors, and other measures, who when given 0 6 to 0 8 mg of Digoxin intravenously responded in approximately ten, twelve and fourteen minutes with a marked rise in blood pressure It must be pointed out that in these patients it was felt that the myocardium itself was a principal or definitely contributory factor to the shock state In most instances, however, the cardiac glucosides would have no place in the armamentarium against shock With the appearance of wetness in the bases of the lungs, increasing venous pressure, signs of myocardial failure, and failure to respond to vasopressors and the usual routine therapy, the use of the rapid-acting cardiac glucosides might be extremely helpful, if not lifesaving

INTRA-ARTERIAL TRANSFUSIONS Although extremely popular a few years ago, intra-arterial transfusions have become less and less popular, with the possible exception of their use in the operating room itself, where they are employed, when blood loss has been rather massive, only when very large vessels that can easily be cannulized are available and blood and administering equipment are at hand It would seem that the intravenous route would be just as efficient in all other instances, with the possible exception of a cardiac blockade, such as an infandibular block or similar stenosis in some of the valves, that would prevent the blood on the venous side from adequately or efficiently working over to the arterial tree

It is now felt that the importance placed upon intra-arterial transfusion a few years ago was in reality due to the rate of administration With the modern tandem-type hook-up of blood and the pressure sets that are now available in many of the commercial units, blood can be administered far more rapidly than it can ordinarily be lost unless there is actually a hole in such vessels as the aorta or its primary divisions Even in blood loss from these sites, pressure by the surgeon on the bleeding point would permit rapid replacement of the blood lost when the team is well organized for this type of accident Care must be taken, however, that the pressure sets not have the hazard of air embolism

PRINCIPLES OF TECHNIQUE OF INTRAVENOUS THERAPY

Since most of the patients in the recovery room will require intravenous therapy, it seems pertinent to call attention to some of the details of the technique In recent years, most surgical patients leave the hospital with a nightmarish recollection of "all of those shots," but it is "those shots" and injections that make it possible to maintain the body at a nearly physiological level until normal body mechanisms are re-established Not only must "the needle" be used properly, when indicated, but likewise

needle If rapid administration is likely to be required, the largest peripheral vein available should be used The saphenous vein at its origin just above the medial malleolus, the cephalic vein in the forearm and the basilic vein in the antecubital space are usually large enough to allow rapid admin-

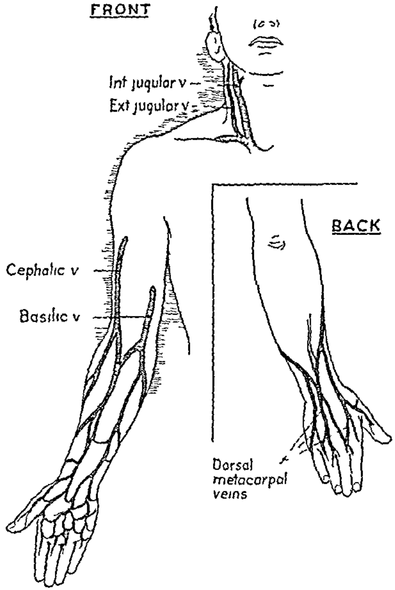

Fig 6 Main superficial veins of the upper extremity and neck

istration If repeated infusions are probable, the initial injection should be at the most peripheral site, working proximally If a suitable peripheral vein is not apparent or vasospasm exists, it is suggested that the extremity be completely covered by two comfortably hot towels, which are then covered by a dry towel and left in place for a minimum of five minutes In

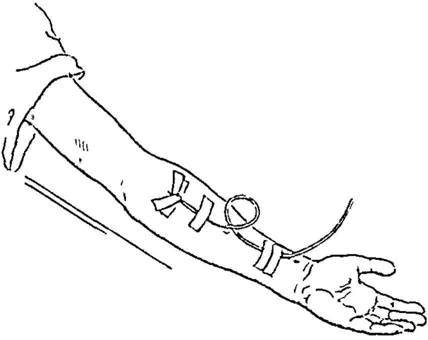

Fig 7 Ideal location for infusion, allowing mobility of upper extremity Note method of fixation

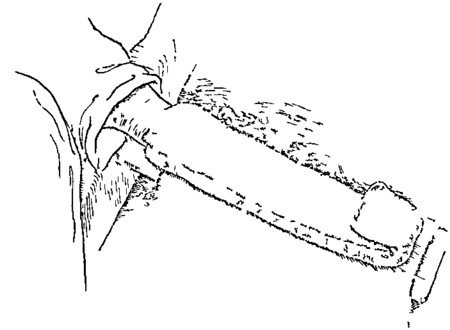

Fig 8 Extremity wrapped in hot towels to produce peripheral engorgement

many instances this will cause sufficient increase in peripheral venous engorgement to control the vasospasm or make a suitable vein apparent

Technique of Insertion of Needle

A tourniquet should be applied proximal to the site selected for injection to bring out the vein to its maximum fullness Care should be taken that the tourniquet does not produce pressure in excess of the arterial pressure The site of injection and surrounding area are cleansed with 70 per cent alcohol If the vein bulges into the skin, direct insertion into the vein should be made When the vein is palpable but not visible, stimulation by massage, light taps, or milking action may cause it to become more prominent Deep veins should be approached by first penetrating the skin

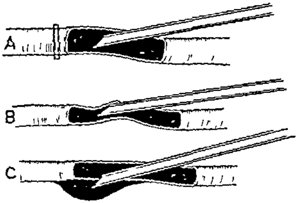

Fig 9 Insertion of needle with sharp point penetrating vein posteriorly, producing hematoma

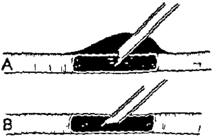

Fig 10 Insertion of needle with rotation of point preventing posterior penetration

Fig 11 Properly inserted intravenous needle lying almost parallel to vein and advanced far enough to make secure

with the needle at an acute angle and then, as a separate maneuver, placing the point of the needle within the vein Care should be taken that the needle does not collapse the vein or perforate both walls These hazards are best avoided by slightly depressing the outer wall with the tip of the needle as it enters the vein After blood flows into the syringe, indicating entry into the vein, further advancement of the needle into the vein with a threading action will make the position of the needle more secure The needle should be held firmly in place with adhesive tape, allowing the adapter to remain visible but properly anchored The tubing should be looped and taped to prevent pull on the needle during the patient's movements Any pull that does occur will then be on the tubing instead of the needle

Safety of Solutions

Before actually allowing the infusion to enter the body, a recheck of the label on the bottle should be made to insure safety Blood solutions, of course, should be checked before the needle is introduced, but it is a good habit to make a last final check just as the transfusion is started The tubing and the filter must be cleared of air

Rate of Administration

If shock exists, then a steady stream of the fluid being administered should be delivered even if a bulb must be used to pump it in If the infusion substance is glucose or saline solution, the rate should be established so that a liter is introduced at least every two hours, unless cardiac failure, cor pulmonale, or pulmonary edema is threatening

After the infusion has been started, check should be made frequently to assure the patient's comfort, to prevent infiltration, and to allow mobility of the patient If medication is added to the infusion substance, a new label, that completely encircles the bottle and clearly indicates the quantity and concentration of medicaments added, should be applied

"Cut-down" or Operative Intravenous Infusion

Sterile trays for use in performing a "cut-down" must be available in the recovery room Too often these trays contain so many instruments and materials that the essentials cannot be easily located Sterile towels, a suitable local anesthetic, a 5-cc syringe with a no 25 (1/2-inch) and a no 20 (1 1/2-inch) needle for introducing the anesthetic, a sharp scalpel, two curved and two straight hemostatic forceps (preferably small), sharp-pointed, medium-sized scissors, 3-0 chromic catgut in a sterile tube to be used for ligatures, and 2-0 Dermalon swedged onto a cutting needle (in a sterile tube) for skin suturing, dressings, and an assortment of polyethylene

tubing with inserted, properly fitted needles are adequate The plastic tubing is preferred by the authors, rather than the cannula, as it can be readily introduced well into the vein and renders the possibility of thrombus formation due to the presence of tubing at a minimum, especially if the tubing is lavaged with sterile saline solution after blood has been infused

The point of origin of the saphenous vein in the lower leg is usually the best site for the cut-down The incision should be transverse, because the location of the vein sometimes is variable, although the vein is generally found just anterior to the medial malleolus The incision should be made 1 to 2 cm above the bony prominence to insure better healing The vein is subcutaneous and the incision should not penetrate to a depth that will damage nerve or tendon

ADMINISTRATION OF BLOOD

Prevention of Reactions

Blood administration carries definite potentialities of harm as well as being lifesaving Extreme caution must be utilized in the prevention of reactions

The prevention of error should start with the drawing of the blood from the donor One should make certain that the blood is carefully drawn in adequate quantity, in the proper type syringe that will not hemolyze the blood, the syringe should be dry and as little pressure utilized as possible Once the blood has been obtained, as soon as possible it should be correctly labeled by someone who knows the patient, and be turned over to the laboratory for typing Every step of the procedure should be rechecked so as to avoid error

When blood is to be obtained from the blood bank, the person taking the blood from the bank should carefully check it before agitating it It should be seen that it contains no gas, and that the color is consistent with that of normal blood, that is, that there is no greenish or unusual discoloration The hemolyzed portion above the settled blood should not be more than half of the plasma portion There should be no floating colonies scattered through the blood, and, when the bottle is gently agitated, no excessive clots should be seen Prior to the transfer of the blood from the bank, the type, the Rh factor and the serial number and name of the donor should be checked with whatever form is being utilized in the specific hospital The blood should then be signed for and transferred to the recovery room

In the recovery room a recheck should be made of all the points checked at the blood bank and the blood turned over to some person who knows the donor The donor's name should never be abbreviated in any

form, even the middle name should be included All information placed on the labels should ideally be printed and not written

Prior to the administration of blood, the intravenous infusion set should be checked to see that it is working adequately and the blood identified as being correct, as previously mentioned Only then should the blood be administered

During the intravenous infusion, watch should be maintained for abrupt changes that are inconsistent with the administration of normal compatible blood If there is any suspicion whatsoever that the blood is not compatible, its flow must always be stopped at the needle and another infusion started immediately, using some crystaloid solution Blood should then be drawn from the patient immediately, and this blood sent to the blood bank, with the blood remaining in the bottle that was being used for the transfusion, where re-crossmatching and rechecking are done and further evaluation is made Even an empty bottle should be returned to the laboratory

Control of Reactions

When indications of blood incompatibility occur, ordinarily the following steps should be carried out Blood should be drawn from the patient immediately upon discontinuance of the intravenous infusion Other samples probably should be drawn after an hour, three or four hours, and eight hours and then at twenty-four hour intervals, to determine if there is an increasing hemolysis The patient should be kept dry, and the urine examined for evidence of hemoglobin If necessary, a catheter should be placed in the bladder to obtain samples at intervals

In obtaining blood for study of hemolysis, extreme care must be taken that the syringe is dry and that gentleness be utilized When there is doubt as to whether or not the hemolysis is due to the technique of drawing blood, another sample must be quickly drawn A portion of this sample can be sent to the laboratory where it can be gently centrifuged so that an estimation can quickly be made as to whether or not a hemolytic reaction has occurred

The treatment of reactions to transfusion is primarily symptomatic Lately cortisone has been added to the armamentarium of the treatment of the hemolytic type of reaction The primary pathological process seems to be a hepatorenal depression and, in some instances, a definite lower nephron type of syndrome It is the feeling of many that the greatest hazard in this type of pathological reaction is the failure to maintain correct water and electrolyte balance If one can tide the patient over a two-week period, the chance of survival becomes increasingly probable In some instances, the artificial kidney may be a valuable instrument in maintaining electrolyte

Clinical Analysis of Transfusion Reactions*

CLASSIFICATION	ETIOLOGY	CLINICAL FINDINGS	LABORATORY PROCEDURES	TREATMENT
1 Hemolytic† A Intravascular hemolysis of incompatible donor cells		The hemolytic crisis (1 to 4 hours duration) Onset usually after 100–200 cc Severity of symptoms depends largely upon isoantibody titer of recipient s serum *Cardinal symptoms* Feeling of fullness in head generalized tingling and substernal oppression Lumbar pain Chill followed by T to 105 F *Other findings* Restlessness anxiety Nausea and vomiting Collapse Low blood pressure *The renal complications* Mild case Tran ient oliguria with nitrogen retention Severe case Persistent oliguria or anuria Death due to uremia in 4 to 10 days unless diuresis ensues *Under anesthesia* Skin reaction Hypotension Capillary oozing	Venipuncture immediately and 6 to 18 hours after reaction Hemoglobinemia and bilirubinemia Urinalysis (within 4 hours) Color—dark brownish to red Protein—positive Benzidine—positive Microscopy—few red cells and pigmented casts Recheck grouping and Rh type of patient and of blood in donor flask Recheck crossmatching Centrifuge blood from donor flask for presence of hemolysis If Rh negative check recipient s blood for anti Rh agglutinins *If donor is Group O and recipient is Group A B or AB titrate the donor s serum against recipient s cells*	*Preventive* Use of meticulous laboratory tech nique carefully supervised Avoidance of mistakes in labeling flasks etc Avoidance of use of frozen blood old blood etc *Active* Stop transfusion at first sign of reaction Epinephrine hydrochloride Treat shock if it develops There is no satisfactory treatment for renal complications al though many still recommend alkalinization Symptomatic treatment Cortisone helpful Keep good electrolyte balance
1 Intergroup (ABO)	*Administration of* Group A B or AB blood to Group O recipient Group B or AB blood to Group A recipient Group A or AB blood to Group B recipient			
2 Intragroup (Rh)	*Admin stration of* Rh positive blood to sensitized Rh negative patient			
B Intravascular hemolysis of recipient s cells	*Adm nistrat on of* Group O blood high in anti A or anti B agglutinins to A B or AB recipient			
C Intravascular hemolysis of compatible donor cells	*Admini tration of* Over age blood Blood stored at too high a tem perature			
D Tran fusion of hemo lyzed blood	*Administrati n of blood showing hemolysis due to* Poor technique in collection Freezing			
2 Pyrogenic	Introduction into blood stream of foreign material (protein dried blood living or dead bacteria bacterial metabolites etc) Exceedingly small amounts of pyrogenic substances will pro duce reactions (pyrogen = fever producer)	*Cardinal symptoms* Mild case Slight chill Mild fever Severe case (rarely fatal) Prolonged chill (during or after transfusion) Fever (1 to 4 hours duration) Rarely cyanosis and marked prostration	Use above procedures to rule out hemolytic reaction	*Preventive* Use disposable equipment or carefully follow instructions for cleaning and sterilizing equip ment *Active* Stop transfusion at first sign of reaction Calcium gluconate (ntravenous)

3 Allergic	Introduction of donor allergens into patient's blood Passive transfer of donor hypersensitivity	Urticaria Asthma Angioneurotic edema	Study of patient for causes of allergy	*Preventive* Use fasting donors Do not use allergic donors *Active* Stop transfusion unless only symptom is mild urticaria Epinephrine hydrochloride Antihistaminics
4 Circulatory overload	Rapid administration of blood to patient with weak heart	Pulmonary edema Signs of cardiac failure Cardiac arrest		*Preventive* Except in extreme emergencies, take at least 1 hour to give 500 cc. of blood Do not overload patient with intravenous fluids
5 Embolic	*Administration of* Blood containing clots Air	Symptoms of embolism		*Preventive* Always filter blood Do not give blood under pressure if avoidable because of danger of air embolism

* Courtesy of R P Birge M D and Abbott Laboratories

† Not all hemolytic transfusion reactions are due to error in technique For further information concerning reactions as well as other blood banking problems the following reference may be consulted. Blood Transfusion, by DeGowin Hardin and Alsever (W B Saunders Co., 1949)

balance However, it should be the rare patient in whom the more conservative measures, such as the use of exchange resins, suction and the administration of appropriate fluids, do not prove adequate

The sedative antihistaminic drugs and such simple agents as codeine and aspirin seem to be capable of controlling the pyrogenic and allergic type of reactions Circulatory overload should be treated by the use of phlebotomy The specific management of the pulmonary edema is accomplished with antifoam agents, oxygen and positive pressure, sedation, and the like Embolic type phenomena should be treated specifically, depending upon the type of embolism and the area involved Citrate toxicity may exist, however, in tens of thousands of administrations of blood, the authors have been unable to find a patient in whom they honestly and sincerely believe this to be the diagnosis However, there would be no harm in the use of calcium gluconate or lactate or similar agents, in those patients to whom large quantities of blood have been given, primarily to create a balance between the calcium and sodium and potassium, rather than as a specific therapy for citrate intoxication One gram of the calcium gluconate may be administered for every three to five units of blood Of greater concern is the loss of platelets or the destruction of other important elements normally found in the blood that are not present in bank blood It may be that, with very large volumes of transfusion, as an exchange type transfusion is approached, the loss of these elements in the administered blood may prove a real hazard Therefore, when large quantities of blood are used, every attempt should be made to obtain whole, fresh blood as the number of units administered increase in a specific transfusion

The table on pages 120 and 121 should be consulted for further details of transfusion reactions and their treatment

RESPIRATION

NORMAL RESPIRATION

Normal respiration should be quiet and effortless There should be an active, short inspiratory phase with a passive, noiseless expiratory phase, and then a resting pause In disease states, this pattern is changed, there may be an increase in rate, an increase in the effort, or prolongation of either the inspiratory or expiratory phase Respiration should always be silent Whenever noise is present, this implies obstruction Even the so-called normal snoring of sleep denotes obstruction and limitation of respiration

The normal individual has a rather complex system of protective mechanisms maintaining the integrity of his respiratory system In a normal individual the air that is inspired is warmed and humidified by the respiratory passages Irritants, such as gases or foreign matter striking the nose or

throat, cause either a cough or a sneeze Foreign particles are filtered out by the flypaper action of the mucosa or engulfed by the wandering phagocytes of the respiratory system Secretions which are normally present are acted upon by enzymes and, by the process of peristalsis in the very terminal bronchioles and the ciliary activity of the mucosa, are swept upward toward the mouth and nose where they are removed by either coughing, sneezing, or expectoration Under ordinary conditions, the local defenses of the body would be able to prevent complications even if a small segment of the lung were tied off and isolated from these normal protective mechanisms It must be remembered that, under normal conditions, the alveoli are filled with air If for any reason these alveoli do not receive air by the normal breathing mechanism, they will suffer a hypoxic damage It is to be noted that the alveoli obtain oxygen directly from the external environment If a bronchiole is obstructed, the alveoli distal to this area become hypoxic and leakage occurs from the capillary bed into the local area If defenses are adequate, this obstruction may go unnoted However, if because of anemia, debility or other reasons, the local defenses are inadequate, infection may occur in this obstructed bronchiole

ALTERATIONS OF RESPIRATION DUE TO SURGERY

Surgery causes a real alteration in respiration A few of the factors responsible will be mentioned briefly

Narcotics

Narcotics cause a depression of ciliary activity, depression of respiration, depression of the cough reflex and over-all quiescense of the individual with a tendency towards respiratory acidosis and rapid, shallow respirations or slow, depressed respirations It would be expected that their use would increase chest complications in all patients who had a preoperative bronchitis, bronchiectasis, or increased secretory activity as well as in those with asthma or similar conditions

Position

The usual position of the patient in bed is that of flexion, causing the diaphragm to be elevated and interfering with the aeration of the diaphragmatic portion of the lung Very frequently patients are in a rather abnormal position during operation, e g , the prone position and the lateral flexed position These abnormal positions cause a compression of the alveoli, and, if they are maintained over a long enough period of time, the tissues suffer from hypoxia and there is an increased edema in the alveoli that are collapsed If tissue resistance is not high enough, the area affected becomes an excellent site for an infective process

Site of Operation

Thoracic complications statistically parallel the degree of interference with respiratory function Therefore the site of operation is an important factor in the frequency of thoracic complications Operations on the head are associated with marked depression of the respiratory function as well as interference with the cough reflex Intrathoracic operations are attended with a greater incidence of thoracic complications than are abdominal operations Of the latter, upper abdominal operations are followed more often by thoracic complications than are lower abdominal operations, while peripheral surgery is the least apt to cause trouble in the chest

Pain

Pain causes limitation of motion and depression of respiration To avoid pain the patient refrains from coughing The accumulations of secretions resulting increase the danger of atelectasis

Distention

The patient who has abdominal distention has elevation of the diaphragm with compression of the basal alveoli causing atelectasis The ascent of the diaphragm secondary to distention causes compression of the alveoli with local hypoxia, local edema and the potentiality of infection In addition, the ability to cough is markedly impaired, not only because of the pain, but also because of the relative ineffectuality of the muscle groups and the relative inefficiency of respiration

Irritating Gases

Some anesthetic agents produce increased amounts of secretions, which must be eliminated at the termination of the operation

Aspiration

Aspiration of vomitus or regurgitated material is an ever-present hazard in any surgical patient, especially the unconscious one Studies have shown that as high as one-third of the patients may be expected to aspirate secretions from the gastrointestinal tract This may cause an actual chemical bronchitis and set the stage for an aspiration pneumonitis

Binders

Tight binders or dressings of various types may limit respiration to the degree that they interfere with proper aeration and thus cause chest complications

Oral Hygiene

It is extremely difficult to maintain good oral hygiene in the immediate postoperative period Poor oral hygiene may provide a means for the spread of infection from the upper to the lower respiratory tract

Obstruction to Respiration

The unconscious patient almost always has partial obstruction whenever he is lying on his back unless there is an artificial airway in place In addition, certain disease states may cause encroachment upon the airway and obstruction to respiration Whenever there is obstruction to respiration, there is an increase in negative pressure within the chest as well as a fall in oxygen tension combined with carbon dioxide accumulation and a greater possibility of effusion which will lead to thoracic complications

Dehydration

Dehydration, which may be a concomitant of many of the disease states, causes a thickening of respiratory secretions which become increasingly viscid with the passage of time Because of the depressed ciliary activity from narcotics or the depression of respiration from internal-external causes, these secretions build up, causing atelectasis with the subsequent possibility of infection

Anemia and Cardiac and Respiratory Diseases

Anemia and hypoproteinemia are both factors which may predispose to thoracic complications in that colloidal osmotic pressure of the blood is not maintained and the ease with which fluid leaks from the pulmonary bed may result in thoracic complications

Cardiac diseases as a group predispose to thoracic complications owing to the pulmonary overload and leakage into the vascular bed with the resultant build-up of secretions and setting the stage for secondary infection

Primary respiratory diseases that ordinarily can be overcome with ease, in the presence of a diminished defensive mechanism, negative nitrogen balance, or similar strains upon the surgical patient, predispose to thoracic complications

GENERAL MANAGEMENT

Preoperative Care

The management of the surgical patient, as far as his chest is concerned, starts in the preoperative period A history is obtained and physical

examination is performed to disclose such deficits as low plasma concentration, overload of the heart, dehydration, acid base imbalance, poor hygiene and low circulating blood volume If possible, and unless the treatment is of an emergency nature, deficiencies are corrected before surgery is undertaken

In addition, prior to the time of operation, the patient should be taught to cough and told what he will be expected to do in the immediate and early postoperative period The importance of the deep breathing and coughing must be explained to him while he can ask questions and practice the coughing and deep breathing exercises It is extremely difficult to acquaint the patient of his role in the postoperative care when he is confused by narcotics, or pain, and is fearful lest he hurt himself

In those patients in whom thoracic complications are to be especially feared, cultures of secretions may be made and proper antibiotic therapy instituted prior to the time of operation This regimen would probably be indicated only in the patient who has such a condition as bronchiectasis or severe bronchitis with productive secretions

When taking the history, one should be sure to inquire as to the occurrence of thoracic diseases such as frequent colds, chronic bronchitis, productive cough and asthma Very frequently, being forewarned, one can have available the proper bronchodilators or other specific drugs that have proved effective in the past, or be prepared to prevent these complications

Stir-up Regimen

The stir-up regimen is probably the most important single factor in the prevention of thoracic complications This regimen is so important that it should be made an integral part of the postoperative management of almost all patients who have a history of disease states which predispose to thoracic complications It consists of six factors (1) cough, (2) deep breathing exercises, (3) change in position, (4) mobilization, (5) narcotics and sedatives and (6) the use of carbon dioxide The orders should be written with instructions to the nurse to record in the chart each time they are carried out

COUGH The patient should be instructed to support the area of the incision very carefully and carry out the cough exercises that were taught to him in the preoperative period These cough exercises should be done at intervals of every fifteen minutes to every hour, depending upon the amount of secretions

DEEP BREATHING EXERCISES The patient should be instructed to take six to ten deep breaths every fifteen minutes The cough exercise may be carried out following the deep breathing exercise The nurse must stand by

while these exercises are carried out, and should write comments and observations concerning them on the chart

CHANGE IN POSITION The patient should be instructed to turn from one side, to his back and to the other side every fifteen minutes to every half-hour The patient should not be aided unless this is absolutely necessary as the mild exertion is usually helpful rather than harmful to the patient Thoracic tubes should be so placed that they will not interfere with this maneuver

MOBILIZATION The patient should be encouraged to move his arms and legs in rhythmical exercise so as to diminish the chance of peripheral stasis and thus lessen the likelihood of phlebothrombosis or thrombophlebitis with its subsequent threat of pulmonary embolic phenomena Slight exertion is also helpful in that it increases deep breathing When possible, the patient may be permitted to sit on the side of the bed with his feet on a chair or he may even be aided in walking about the bed Walking, of course, would be ambulation rather than mobilization However, very frequently, ambulation is not possible, but certainly active exercise or mobilization is possible in almost all postoperative patients

NARCOTICS AND SEDATIVES Almost all of the commonly used narcotics depress the cough reflex and the ciliary activity These are the two clean-up mechanisms of the lungs When they are depressed, secretions tend to build up, predisposing to atelectasis Not only do the narcotics depress the cough reflex and the ciliary activity, but in addition they depress respiration, tending to cause diminished aeration in the dependent portion of the lung with the accumulation of secretions The narcotics and sedatives also diminish the activity of the patient so that the patient remains quiet and sleeps for long periods of time, both of which may be harmful The short-acting narcotics such as Nisentil may be used and, at the time of the peak of action, the patient may take his coughing and deep breathing exercises, and thus eliminate the secretions that have accumulated Since the effects of Nisental wear off in about an hour, this drug lends itself well to this routine In many instances, the narcotics may actually diminish alveolar ventilation to the degree that they may produce respiratory acidosis and hypoxia, both of which tend to cause leakage from the pulmonary capillary bed into the lung with the potentiality of harm Very frequently, blocks of a group of nerves may be extremely helpful in producing freedom of pain, permitting the patient to cough rather energetically

CARBON DIOXIDE Carbon dioxide may be used effectively in the stir-up regimen For those patients who will not cough or breathe deeply carbon dioxide may be poured, through a simple tube leading from a tank that has a control valve on it, over the face from a distance of 10 to 12 inches,

so that actually a mixture of carbon dioxide and air is being administered If a carbon dioxide-oxygen mixture is employed this mixture is pulled behind the secretions and is quickly absorbed in approximately fifteen minutes, thus increasing the chance of an atelectasis With a mixture of carbon dioxide and air, there will be a high percentage of nitrogen which will take approximately fourteen hours to be absorbed from the alveoli Thus, if the patient coughs within the next hour or hour and one-half, the tussive squeeze will aid in the elimination of secretions Patients who cannot be made to cough by any other fashion can be made to go into an actual paroxysm of coughing with this routine Very frequently, objections are raised to this technique because it is feared that suture lines will be torn and wound dehiscence will occur as a result However, it may be pointed out that it is preferable to have the patient go through a paroxysm of coughing at the command of the medical team rather than develop a thoracic complication and then cough at much more frequent intervals at a later date when the wound is weaker We have never seen a patient in whom we believe that the use of carbon dioxide could honestly be incriminated as a cause of a wound dehiscence We have seen many patients, however, in whom we believe that the judicious wise use of carbon dioxide may have prevented chest complications with subsequent coughing and wound dehiscence

We believe that distention and coughing of an uncontrolled nature are two of the most important factors in wound dehiscence, but that elective coughing as caused by the administration of carbon dioxide and air will not increase, but rather decrease, the occurrence of wound disruption

Tracheobronchial Toilet

A very important adjunct of the stir-up regimen and the prevention of thoracic complications is the technique of tracheobronchial toilet Tracheobronchial toilet implies the use of some means of removing the secretions that have accumulated in the thoracic passages The most common method employed is that of passing a silk-woven or rubber catheter down into the oropharynx, through the larynx, and into the trachea or primary or secondary bronchi, removing secretions contained therein The following method, however, is favored by the writers After a topical anesthetic has been placed in the nose, a soft rubber endotracheal tube is passed into the nose down through the larynx A suction catheter is then passed through this tube to remove the secretions By this technique the suction catheter and the endotracheal tube can be directed into one or the other side of the main divisions of the trachea, thereby obtaining some degree of specificity A coude type catheter could also be used This catheter

has the advantage of having a greater chance of reaching the area where the operator wishes it to go Between the aspirations, oxygen may be administered If the suction catheter becomes obstructed with very viscid secretions, it may be cleansed with ease and again passed, when desired, through the endotracheal tube The writers feel that this is a less traumatic procedure than the direct application of the suction catheter through the larynx without the use of the endotracheal tube

Care should be taken that the catheter not remain in the lung longer than is absolutely necessary In fact, the catheter should not remain in the lung for longer than a few seconds at a single treatment In the very poor-risk patient, oxygen should be administered before and between each attempt at aspiration in order that no strain be placed upon the patient When it becomes necessary to repeat tracheobronchial aspirations more frequently than three to four times in any twenty-four-hour period, it might be wise to consider performing a tracheotomy However, the writers have seen numerous instances in which one or two aspirations have cleared a rather massive atelectasis After all, it is the cough that is of greatest importance in the cleansing of the tracheobronchial tree The catheters merely remove the material once it has been brought to the larger divisions of the tracheobronchial tree In fact, in some instances the mere attempt at placement of the tube has resulted in the elimination of the material which had been causing the atelectasis

ATELECTASIS AND POSTOPERATIVE PNEUMONIA

We believe that when the stir-up regimen is carried out the incidence of atelectasis or pneumonia can be markedly diminished Although postoperative pneumonia is at present a rather rare occurrence in most modern hospitals, atelectasis still is found rather frequently In fact, the more frequently one searches for this complication, the more apt one is to find it However, atelectasis properly treated by the stir-up regimen and such techniques as aerosol therapy rarely causes any serious difficulty It can be said that a high percentage of all postoperative pneumonias are atelectases which have been neglected Antibiotics alone may diminish slightly the occurrence of postoperative pneumonia, but of far greater importance is the use of the stir-up regimen combined with adequate aerosol therapy, utilizing an antibiotic as one of the aerosols

Atelectasis should be considered as a respiratory emergency and treated as such There is no doubt whatsoever that bronchoscopic aspiration, in the hands of skilled individuals, is the treatment of choice for most atelectases of a specific nature Anterior and posterolateral films should be obtained When these show a specific atelectasis in a specific area, the treat-

ment of choice is, of course, bronchoscopic aspiration. Usually, however, no specific atelectasis can be demonstrated, but rather an over-all diffuse accumulation of secretions. For this state also the bronchoscope is an instrument of diagnostic specificity and it can be employed effectively in the treatment as well. Sometimes within a few hours following aspiration, even though treatment has been properly executed, the secretions will recur. When this happens, probably the best treatment is the performance of a prophylactic-type tracheotomy. Although tracheobronchial aspirations are preferred by the writers, when these fail to control the situation they do not hesitate to have a tracheotomy performed. An elective tracheotomy carries far less hazard than does a postoperative pneumonia. Indeed, a prophylactic tracheotomy should be contemplated in patients having radical neck dissection, massive trauma to the floor of the mouth, or any condition in which the airway cannot adequately be maintained. Even in the unconscious patient, if it is anticipated that the unconsciousness will last over a period of days, it is believed that a prophylactic tracheotomy might be of tremendous aid in preserving life. In rare instances an endotracheal tube may be utilized for a matter of twenty-four to thirty-six hours instead of performing a tracheotomy, while the appearance of physical signs which will show whether or not unconsciousness is expected to continue or will be terminated within the next few hours is awaited. It is believed, however, that more harm has been done by the omission of a tracheotomy than by its judicious use.

Atelectasis classically occurs in the first three postoperative days, in contradistinction to infection and wound abscess which usually occur after this time. The classical signs are tachycardia, tachypnea (usually the respiration rate is from 30 to 40 or more) and dilatation of the ala nasi. There may be slight cyanosis. In some instances the movement of the chest on the affected side is restricted. Usually diminished breath sounds, decreased resonance, or rhonchi are present. Rales are rarely noted. The mediastinum is usually displaced towards the affected side. This is most apt to occur when there is a massive atelectasis. There may be signs of air hunger, such as twitching, nervousness, tremor, and disorientation from the lack of adequate oxygenation. Fever may or may not be an early sign, however, when it is present in the early postoperative course one must always search for atelectasis. In most instances, the x-ray picture resembles that of a patchy bronchopneumonia, with elevation of the diaphragm on the side affected, shifting of the mediastinum to the affected side, increased density, and narrowing of the rib cage. These findings all point towards definite, concise atelectasis. Sometimes, however, the x-ray picture is not as characteristic as one would desire. When the clinical signs point to

atelectasis, one should not hesitate to treat the patient for this condition in spite of the absence of classical x ray signs It is not at all unusual for a patient's condition to change within a matter of one hour and for the x-ray to show clearing of the lung fields in a few hours following bronchoscopic or aspiration treatment

HYPOXIA

Diminished oxygen tension or hypoxia is present in many postoperative patients This may result from many causes, such as the residual effect of curare or other muscular relaxants, excess depression from narcotics or anesthetic agents, increased demand from toxicity or fever, resection of lung tissue, carcinoma of the larynx, muscle and nerve paralyses, the presence of foreign bodies, bronchial constriction, increased intracranial pressure, tight dressings, increased intra-abdominal pressure, hydro- and pneumothorax, pneumonia, atelectasis, congestive heart failure, pulmonary infection, anemia, hemorrhage or shock, coronary occlusion, and general cardiac anomalies The more one searches for evidence of diminished oxygen tension in the immediate postoperative period, the more one finds that this is a rather common concomitant of the stresses of surgery and anesthesia

In addition, concomitant to this hypoxia or hypoxemia, is the presence of excess carbon dioxide or hypercapnia The two states frequently coexist

From a functional point of view, the classification of hypoxia by Drs Comroe and Dripps has now become a classic Five categories are listed

1 Inadequate oxygenation of the normal lungs due to such causes as deficient oxygen in the atmosphere, obstructions to flow, pharyngeal or laryngeal abnormalities, obstruction to flow in the tracheobronchial tree, and insufficiency of respiratory muscles due to many of our commonly used drugs, tight dressings, and the like
2 Inadequate oxygenation of an abnormal lung, that is, such states as insufficient quantity of functioning lung tissue resulting from pneumothoraces, pneumonia, infarction, congestive heart disease, emphysema, and the like, or improper alveolar mixing of inspired gases or poor diffusion of gases across an alveolar capillary membrane caused by fibrosis or pulmonary infection with exudate
3 Venous arterial shunts, as seen in some types of heart disease or in persons in whom blood is circulating through unaerated alveoli
4 Inadequate transport of oxygen by the blood caused by diminution of active hemoglobin or deficient circulation, such as is seen in association with hemorrhage or shock, or cardiac disease

of hypoxia However, the presence of a small amount of carbon dioxide would cause a definite increase in the rate of respiration

The nervous system is a much better indicator for oxygen lack In fact, if the lack is really acute, unconsciousness may develop within forty-five to sixty seconds If hypoxia, however, is slow in onset, the perception may be dull and the patient may be completely unaware of the fact that his sensorium is undergoing a radical change Symptoms of severe hypoxia include headache, depression, apathy, drowsiness or excitement, and muscular twitching The patient may cry, sing, shout, or thrash about, there may be impaired judgment and dull senses, even to the degree of loss of consciousness, with spasms or terminal convulsions When oxygen want is less severe, one may find that the patient has a feeling of well-being, a state of euphoria and lack of judgment, and this may progress to boisterousness, argumentativeness, emotional instability, headache and finally lassitude and the states previously mentioned In fact, one of the most frequent errors made in the postoperative management is that of giving a patient showing the central nervous system signs of hypoxia a respiratory depressant, such as morphine or one of its substitutes, instead of giving oxygen and aiding the respiratory exchange It would be considered much better practice to treat patients who are thrashing about, uninhibited, confused, or in a similar state, by first giving them oxygen, and then, after observation and only when it is certain that oxygen want is not an important factor, administering small repeated doses of analgesics

Pulse rate is probably the most sensitive sign of hypoxia The pulse will accelerate progressively with increasing hypoxia and slow when the oxygen want is severe There is a definite rise in the pulse rate long before any cyanosis is evident In fact, cyanosis should not be regarded as a real sign of oxygen want It is a very important sign of respiratory and/or circulatory dysfunction However, the absence of cyanosis should not be reassuring to the clinician

Blood pressure changes are of relatively little significance until hypoxia has progressed to a rather severe degree Since the normal venous unsaturation is 6 volumes per cent and cyanosis is said to occur only when this reaches 11 4 volumes per cent, the appearance of cyanosis indicates a rather advanced stage of unsaturation or hypoxia Cyanosis depends to a great extent on such factors as the color of the room, the light in the room and the amount of blood in the patient. Therefore, it is of relatively little significance unless present to a marked degree

As hypoxia progresses and the patient reaches the crisis, the pulse rate, which had been rapid, may begin to slow as the blood pressure rises, with usually a falling diastolic phase, and, as this continues, the blood pressure

falls rapidly, with a terminal slowing which finally leads to ventricular fibrillation or asystole, if uncorrected

CARBON DIOXIDE EXCESS

Symptoms and Signs of Carbon Dioxide Excess in Order of Increasing Severity

		MILD	MODERATE	SEVERE
Psychic		Discomfort	Dizziness	Unconsciousness
Sensory		Local irritation to upper part of respiratory tract		
Respiration	Rate	Slight or no inc.	Depressed	Arrested
	Depth	Markedly inc	Depressed	Arrested
Blood pressure	Systolic	Increased	Inc markedly	Fall
	Diastolic	Increased	Inc moderately	Fall
Pulse rate			Moderate increase	
Musculature		Twitching	Spasms of muscle groups	Convulsions
Color		Pink due to peripheral dilatation unless oxygen want is added		
Pupils		Variable	Variable	Variable

The above table indicates rather clearly that probably the most important factor in the signs of increased carbon dioxide is an increase in depth rather early, which, as the carbon dioxide accumulation increases, may become depressed or finally arrested The rate is a rather poor indication of carbon dioxide accumulation There is usually discomfort, and dizziness The increase in the systolic blood pressure is also rather significant There is a moderate increase in pulse rate as well Twitching, nervousness and tremors are not at all uncommon Wet, pink, peripheral skin is also quite typical, that is, unless oxygen want is added There are varying degrees of oxygen want and/or carbon dioxide excess However, it must be pointed out that, in many instances, either one or the other may occur alone Especially is carbon dioxide excess apt to occur in those patients in whom respiration is somewhat depressed, the color good, and the pulse and blood pressure a little deviated from normal, that is, respiration is a little rapid, blood pressure is a little high, and the pulse slightly rapid But, all this is compensated for to an apparent degree by the administration of

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The rate of flow of oxygen must be at least 10 liters per minute if one is to avoid carbon dioxide accumulation within the tent, except in the tents which have soda lime-absorbing mechanisms, but even in these it would be best to use 10 liters per minute as a minimal flow

The flush valve must be depressed for thirty seconds after each opening in order to maintain adequate concentrations, or a flow of 15 liters for thirty minutes is necessary The oxygen content should be tested at frequent intervals and the rate of flow changed as indicated

With poor techniques, it is difficult to get as much as 35 per cent oxygen, even with a 15-liter flow With constant attention to details, the tent will give concentrations of about 50 per cent

In the recovery room the tent is rarely used except for a medical patient in whom the cooling effect as well as the oxygen is desirable For the postoperative patient, it is almost impossible to obtain both good postoperative care and good oxygen therapy In addition, the tents are annoying to both patients and personnel from the standpoint of noise and size

Insufflation Techniques

These are probably the most frequently used for oxygen therapy in the postoperative patient Their value is the simplicity of equipment, availability, economy, and ease of administration as well as relative efficiency

NASAL CATHETER TECHNIQUE This consists in the placement of a catheter through the nose into either the oropharynx or nasopharynx The catheter should be distinctly marked so as not to be confused with other similar tubes It is specially constructed so that the distal 3/4 inch to 1 inch, as well as the tip, is perforated with many holes This will diminish the drying and irritating effect of the gases blowing against a small area Extreme drying, especially of the upper respiratory passages, is prevented by connecting the catheter adapter to a tube which in turn is connected to a nebulizer unit of some type The authors do not feel that the bubble-type humidifiers are adequate

The deeper the catheter is inserted, the higher the concentration of oxygen, but with it the greater the danger of the patient swallowing the oxygen and becoming distended Perforation of a viscus and acute distention are hazards to be guarded against

The following instructions are carried out

1 Assemble and check each piece of equipment—regulator, humidifiers, catheter tubing, lubricating material, tape
2 Explain to the patient what will be done, reassure him

oxygen In those patients receiving oxygen and having a depressed respiration, the presence of excess carbon dioxide must always be kept in mind

OXYGEN INHALATION THERAPY

Orders for inhalation therapy should be written in a specific fashion They should include the following

1 Gas to be used
2 Technique of administration
3 Rate of flow and desired concentration, with instructions to increase flow if not attained by a specific rate
4 When, or at what intervals, gas concentrations are to be changed, either increased or decreased

In addition to above, records must be kept of the treatment All safety precautions must be employed—no smoking in the room, post signs at the doorway and in the room and on the tent, remove all matches, cigarettes, and the like from the patient's room

Oxygen Tent Therapy

Tents contain ice or mechanical cooling units They have either convection, motor-blower, or venturi principle for the circulation of the gases The source of oxygen can be from a tank or from a wall outlet

The oxygen tank, tent and canopy are checked outside of the patient's room to make certain that they are functioning properly It should be ascertained that the tank has adequate pressure The tent is checked to see that the soda lime is adequate, if it is present If "blowers" are part of the equipment, it is made certain that they are circulating air It is ascertained that the water has been emptied from the reservoir before therapy is started The tank is secured to the bed by use of the proper retaining straps The valves are opened and oxygen is run at the rate of 15 liters for thirty minutes The temperature regulator is set at 78° F (it should never be less than 15° F below the outside [room] temperature) The canopy is placed over the bed and under the mattress The lower end of canopy is secured under the mattress or under several sheets The canopy is made as gas tight as possible Check is made to see that the temperature is responding, the temperature is then lowered to about 72° F The rate of flow is set at 15 liters for thirty minutes, or, when starting the treatment, the flush valve is used for the first thirty seconds, after which the flow is adjusted according to the need The concentration and temperature of the tank are checked before the attendant leaves the patient

The patient eliminates about 300 cc of carbon dioxide per minute

most efficient position in respect to other tubes to be inserted, obstruction, etc

8 Ask the patient to breathe in and out through his mouth and insert the tube so that its natural curve will take that of the soft palate

9 Insert the tube along the floor of the nose as this part has the greatest space

10 When the tube has been inserted to its adhesive tape mark, inspect its position The tip should be barely visible beyond the soft palate Fix the tube temporarily with adhesive

11 Adjust the rate of flow of oxygen to the requirement

FLOW (LITERS)	APPROXIMATE CONCENTRATION (PER CENT)
3	28
6	30
8	35
10	50

12 Watch the patient for at least five minutes to see if he is swallowing the gas Each time the rate is increased, check to see that this has not stimulated the swallowing reflex

13 If swallowing occurs, withdraw the catheter as little a distance as possible to avoid swallowing

14 Fix the tube in place with adhesive and fix the supply tube so it does not pull against the catheter Place the tube so it will disturb the patient as little as possible

15 The catheter must be changed with each nursing shift every (eight hours)

16 Check the physiological effect for efficiency The pulse is the best guide

17 Percuss the abdomen when in doubt as to air-swallowing Use an intestinal tube to remove gas if it is present Gastric distention may cause a fall in blood pressure and various changes in the pulse This should be kept in mind Gastric distention is to be avoided as it may cause harm

OTHER INSUFFLATION TECHNIQUES Many modifications of the nasopharyngeal and oropharyngeal tubes exist Probably the most valuable are the disposable plastic catheters These are the most easily cleansed and are the least apt to be confused with other types of tubes In addition, there are units which connect to various types of plugs which are placed in the external nares, the gases are forced through these, along the nasal passages

3 Choose catheter 6 to 10 F for a child, 10 to 12 F for a small adult, 12 to 14 F for a large adult

4 Measure the distance from the tragus of the ear to the tip of the nose by using the catheter, mark this distance on the catheter with a small piece of adhesive tape to indicate the approximate amount of tubing to be inserted.

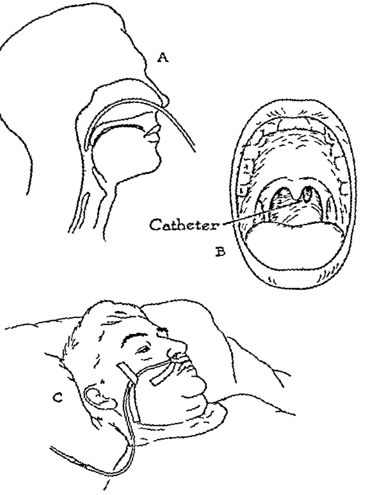

Fig 12 Inhalation therapy Catheter technique Nasal route

5 Lubricate the tube with some form of nonirritating petrolatum (e g , Vaseline) Water-soluble ointments are absorbed too quickly Oily materials may be aspirated and cause lipoid pneumonia

6 Start a low flow of oxygen before inserting the tube, in order to check for patency, to make certain that there is no water in the tubing, and to lessen the chance of a careless turn of the regulator, producing a blast of oxygen which might harm or frighten the patient.

7 Check the nares and plan for the insertion of the catheter in the

washed out by turbulence within the mask as well as by physical wash-out

Because there is some rebreathing, the mask is less dehydrating to the respiratory passage than is a catheter Nevertheless, it is preferable to humidify the gases so as to keep the ciliary activity at a maximum and intrathoracic secretion at a maximal fluidity

In spite of the above-mentioned problems, persistence and attention to the technique make the use of the mask feasible in many patients who really need high concentrations of oxygen There are many types of masks available The various types and the indications for their use are given below

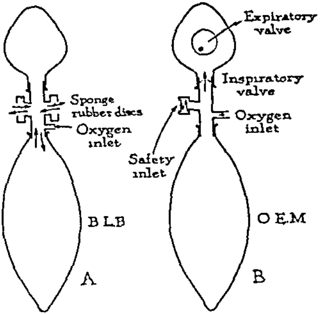

Fig 13 Oronasal mask (BLB and OEM)

NASAL MASKS The BLB (Boothley, Lovelace, Bulbulian) mask is an example of this type These masks are used for patients needing some therapeutic gases in low concentrations They are rarely used in the recovery room or for seriously ill patients

ORONASAL MASKS Two good examples of these masks are the BLB and the meter masks

The BLB mask was standard equipment in many shock wards during World War II It gave good service with easy maintenance In this mask, gas flows from a common duct into a two-way chamber, either towards the mask or, during exhalation, into a reservoir bag There are two sponge rubber discs just below the mask that prevent air from entering and offer a slight resistance to outflow of the administered gases These masks must

and into the pharynx In the opinion of some, these are more comfortable and are certainly more easily changed than is the standard catheter

Other modified units of metal or plastic that insufflate the gases into the nares have been devised Their over-all efficiency is probably less than that of the standard equipment, but can be increased by increasing the rate of flow of the gases They are probably safer than catheters from the standpoint of gastric distention, their use is actually only a matter of personal preference

Masks

When ever the patient's requirement of oxygen is above 50 per cent the mask technique of administration becomes the one of choice In many hospitals this technique is preferred regardless of the concentration desired It has the disadvantage that the mask must fit the face correctly or poor therapy will result Also the mask is difficult to use in certain edentulous patients The restless or uncooperative, nervous patient presents a real problem because the mask is dislodged or removed at frequent intervals This same problem is encountered in many postoperative patients

There are several additional problems associated with the use of masks They are

1 Abrasion of the skin from pressure or accumulation of perspiration or secretions The mask should be removed at least every six hours, and it and the patient's face cleaned, dried, and carefully powdered
2 Collapse of the reservoir bag, making the patient work hard to pull air through the small "safety valve" This should be watched for carefully In masks with no safety valves and also no bag, it must be made certain at all times that the volume administered is at least equal to that of the maximal inspiratory flow rate or volume of the patient When doubt exists, an excess flow is employed An inadequate flow will cause restlessness, fatigue, fighting to take off the mask, and a real possibility of pulmonary edema
3 Accumulation of carbon dioxide When low flows, or even moderately rapid flows, are used, carbon dioxide may accumulate This is a very real danger because the mask increases the mechanical dead space and thus increases the amount of air rebreathed This tends to lead to respiratory acidosis, which can be very difficult to diagnose in a patient requiring oxygen This means that great care must be taken when using a mask in a child or in a patient with a shallow respiration Sometimes, even a relatively rapid flow will not be effective in eliminating the carbon dioxide *If there is doubt, the rate of flow* should be increased so that excess amounts of carbon dioxide are

always be inspected to see that the discs are in place and are clean, and that the bag is clean and free

The meter type mask should be designated "oronasal mask of the OEM (Oxygen Equipment Manufacturers) type" These masks are different from the BLB type in that there is less rebreathing A valve is present to prevent exhaled gases from entering the reservoir bag, and there is a safety valve for ingress of room air, when oxygen flow is inadequate, and a valve of some type for positive pressure exhalation or a simple flutter-type exhalation valve The face pieces of these masks are of two types—one round with a small surface for contact with the face, for standard technique, and the other having a wide, flat surface with an inner flange, for good con-

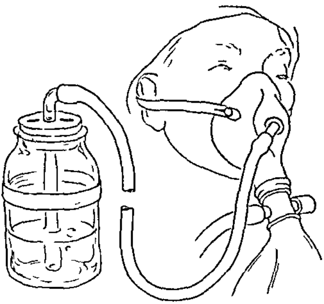

Fig 16 Oronasal mask—OEM

tact when positive pressure is used When positive pressure is employed the rubber flutter valve is replaced by a disc which is perforated This disc affords a variable resistance to exhalation The resistance is proportional to the size of the opening In a variation of this type mask, a plug replaces the expirator valve or disc and the tube through the plug is led to a glass tube under water (Fig 16) The distance the tube is under the surface of the water causes a positive pressure against expiration This is a simple method of making a positive pressure device In general, positive pressure on expiration causes less interference with circulation than does positive pressure in inspiration This form of positive pressure is usually employed in patients with mild pulmonary edema or to aid in the expansion of an unexpanded lung

In addition to the mask, the Oxygen Equipment Manufacturing Com-

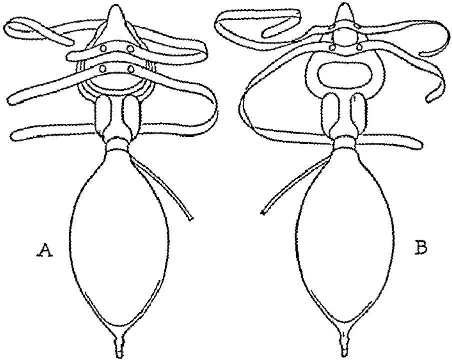

Fig 14 Oronasal mask

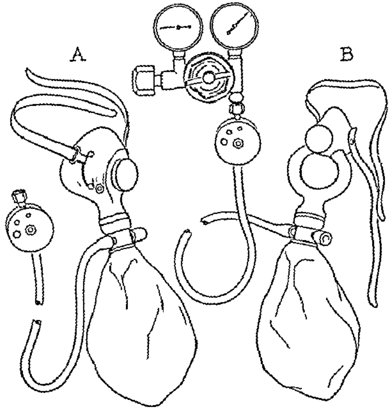

Fig 15 Oronasal mask—meter type

There are many small respirators the size of a man's hand that function excellently for the emergency patient These units usually give alternating positive and negative pressure This pressure is crudely regulated in some and preset in most to a positive pressure of 14 mm of mercury and a maximum negative pressure of 9 mm of mercury Such units are designed for the patient who suddenly stops breathing They should not be used over any period of time, but should be replaced by more adjustable units

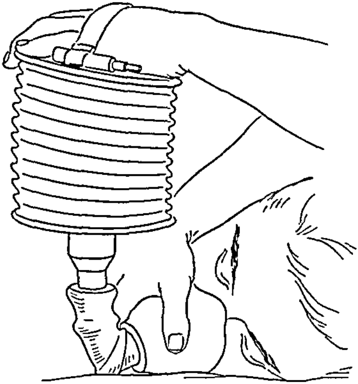

Fig 17 Kreiselman hand bellows

Two other excellent emergency units are the Kreiselman hand bellows and an easily assembled emergency unit that might be called the bag and mask

The Kreiselman hand bellows is nothing more than a simple bellows which, when expanded, draws air or oxygen into the unit and, when compressed, pushes the air into the mask and thus into the patient This unit can be used for the nonbreathing patient until a good respirator is working and ready to be connected

The bag and mask unit can contain an absorber or not, dependent upon the needs With this unit, one can give oxygen and not assist at all, or one can manually assist or actually do artificial respiration There is little to go wrong with this equipment and the expense is almost nominal

The mask alone may be used as a resuscitator It is placed over the

pany makes a device called a "meter" This meter is attached to the reducing regulator With it, one can regulate the concentration of oxygen administered to the patient The concentration leaving the meter is imprinted upon the regulating disc The purpose of this device is to enable one to lower the concentration of oxygen gradually and also to permit varying concentrations It is always wise in a seriously ill patient to lower the oxygen concentration over a period of hours, in order to place less stress upon the patient

RESPIRATORY ASSISTORS AND RESPIRATORS

There are various pieces of equipment on the market that can be called "respiratory assistors" These units are usually made up of the following parts a well-constructed mask (of careful, tight fit), a connecting tube, a regulator that sets the degree of positive pressure, and an indicator for the pressure, some have rate-regulating valves as well Some of the units have an automatic cycling device so that they can be used as respirators

In general, the assistors are used only as an exercise device or, more frequently, for the depressed patient whose respirations are inadequate because of muscle activity depression or central nervous system depression

These units should be used with care, since oxygen poisoning can occur when they are employed continuously over a twenty-four-hour period Dehydration of the respiratory passage easily results from their use In addition, it is possible, with those having automatic cycling devices (respirators), to wash out excess carbon dioxide and create a respiratory alkalosis and apnea The assistor should be used in preference to the respirators However, in order to use the IPPB (intermittent positive pressure breathing) devices that are not respirators, the patient must be breathing It takes a slight amount of negative pressure to trigger the positive phase of respiration Usually the amount of negative pressure is about 1 cm of water or less The less negative pressure needed to cycle the apparatus, the better Also of importance is the speed of flow of gases So very frequently the patient needing the aid of an intermittent positive pressure device has rapid, shallow respiration It would be harmful if the apparatus could not keep up to the rate of inspiration of the patient In some devices, the more negative pressure created by the gasp, the greater the positive pressure rate of flow exerted by the equipment

Some form of IPPB unit should be on hand in all recovery rooms Also, there must always be a respirator of some form These should be connected to a full tank of oxygen as well as be adaptable for connection to the wall oxygen outlet Endotracheal and tracheotomy equipment also should be in readiness

face of the patient, the operator takes a deep breath, and blows into its open end He then permits exhalation and repeats the procedure until aid is obtained The mask may be removed at the end of each passive inspiration so as to aid in the elimination of carbon dioxide This could save a life

The manual methods of artificial respiration should be known by *all* recovery room personnel

AEROSOL THERAPY

Aerosol therapy may be valuable in the preoperative as well as the postoperative period Aerosols are fine mists composed of microscopic-sized droplets which are formed in a nebulizer or mist generator These mists are sometimes referred to as fogs of cold steam The aerosol may be used for the purpose of giving the suspended agent or because one desires to use suspending agents For example, one may use oxygen and humidify it with normal saline solution or Alevaire In this situation the principal agent could be either the oxygen or the humidifying saline solution On the other hand, the oxygen could merely be the suspending vehicle, and the humidity and the "wetting" effect of the Alevaire, the important therapeutic effect

Aerosols are formed by the passage of a fine jet of very rapidly passing gases across a capillary-sized opening This passage entraps small quantities of liquids and breaks them up into fine particles The jet of gas with the entrapped small particles then strikes a baffle plate which further breaks the particles into smaller-sized droplets If the particles are very small, they pass on in the gas, if relatively large, they fall back into the reservoir The gas used may be oxygen from a wall outlet or tank, or the source may be a small motor-driven compressor The equipment used depends upon the patient's needs One can have concentrations of oxygen from approximately 100 per cent to 20 per cent One can use aerosols in tents (body or face), masks (including tracheotomy masks), catheters, and the like In general, the longer the passage way traversed by the aerosols, the more the large particles are filtered out and the smaller all the particles become This is especially true in the inhalation of aerosols The larger particles are filtered out in the nose and throat, the smaller particles continue on The larger the particle the sooner it will be filtered out If the particles are about 3 microns in size, they may reach the terminal bronchioles and alveoli If much smaller, they may get into the alveoli and be exhaled again

Thus, by regulating the size and constituents of the particles, one can determine where the particles will be filtered out in various parts of the tracheobronchial tree If one uses water alone, a vapor or gas is easily produced If one adds glycerin in about 5 to 7 per cent concentration, then

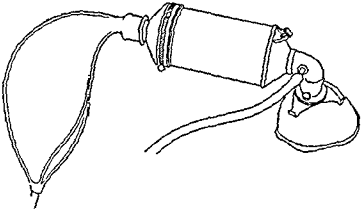

Fig 18 Bag and mask

Fig 19 Mask used as resuscitator

Therefore, all measures previously mentioned in connection with the stir-up regimen—aerosol therapy, inhalation therapy, mobilization—must be part of the skilled surgeon's armamentarium

Aerosol therapy is one of the most effective ways of managing the dehydration and thickening of secretions as well as their sequelae, when combined with the above-mentioned routines

Steam inhalation is helpful, but is less effective, more uncomfortable, less physiological and more dangerous than aerosol therapy It heats the patient when efficient, but it cannot be combined with drug therapy and should not be employed except for the rare home use when aerosol humidity might not be available

It must be pointed out, however, that the nebulization of 1 or 2 ounces of solution in one day will not wet nor thin as much secretions as will 4 to 8 ounces Volumes of liquid are required The authors have never witnessed any difficulty due to fluid volume even when all oxygen outlets in the recovery room are passing through nebulizers Sometimes the increased thinning effect of the aerosolized Alevaire may cause a state wherein there is increased rhonchi and rales Effective stir-up regimen, carbon dioxide-air administration and aspiration will remedy this quickly

The authors prefer Alevaire or Alevaire slightly diluted 1 1 when humidity is desired The greater persistence of the droplet and the spreading, wetting action as well as the slight alkalinity are valuable

The clinical impression has been gained that many patients owe their lives to inhalation therapists, nurses and Alavaire

FOR THE TRACHEOTOMY PATIENT The tracheotomy patient has been discussed admirably by the consultants who most frequently utilize the tracheotomy technique However, the following is true in the authors' opinion All patients having a tracheotomy should be put on aerosol therapy Ideally, the type of generator best used is that of the J H Emerson Company wherein the mist is ideal and it can be warmed somewhat if desired The masks for administration vary One of the finest is that made by the Mist-O_2-Gen Equipment Division of the Production Foundry Company The Ohio Chemical Company's BLB tracheotomy mask and the National Cylinder Gas Company's tracheotomy mask are both extremely useful for many patients

We believe that the lack of the warming, filtering, wetting action of the upper respiratory tract causes an irritative bronchitis in all tracheotomy patients Also, the lack of a good cough places them in a precarious position They must be watched carefully Secretions must be removed One must not tire of removing them Sterile catheters should be available in abundance so that an inflammatory infective process is not added to the irritative

These drugs are all potent, with many good and lifesaving potentials, but they should be used carefully lest excessive side actions occur It is best to use minimal dosage and gradually increase the total dosage After a treatment with any of these agents, one frequently notes that the patient can take a deep breath and cough, whereas before treatment he could barely keep himself oxygenated Retraction of the intercostal spaces and suprasternal areas disappears and the extreme effort of respiration ceases

Humidity

The normal individual inhales air at about 80° F with a humidity of about 35 per cent, and exhales air, at about 98° F , which is nearly 100 per cent saturated In the process of being alive, the individual loses about 750 cc of liquid a day This comes from the various surfaces of the respiratory tree—from the mouth, nose and tongue, down to and including the alveoli With greater exchange, fever, increased dryness of inspired air, and the like, the amount may be markedly increased If there is no disease present, this increased loss will do no harm However, if there are secretions present, they are apt to become more viscid In the postoperative period, which is so fraught with danger of a chest complication owing to the many factors already referred to, any thickening of secretions may mean retention due to such factors as poor ciliary activity, poor breathing, poor cough reflex, and less activity because of pain There is also a greater danger of the production or accumulation of secretions from aspiration, hypoxia, hypercapnia, irritating gases, intubation, the failure of deep breathing, inactivity, suppression of the cough reflex, and the like An extremely high percentage of our American population on awakening start coughing as they first walk about They clear their nasal areas and their lungs, and then go about their business The postsurgical patient does not do this *with anywhere near the same efficiency The heavy smoker* takes his chronic cough as part of his normal existence, for he effectively deals with it in his daily routines

In the postsurgical period, any patient who has a history of sinusitis, bronchitis, morning cough and similar mild disease states must be watched When the individual is "not sick," an obstruction to a bronchiole gradually occludes an area of the parenchyma of the lung, but resistance is high and, with the passage of time, the obstruction is eliminated without infection occurring With disease states and low resistance, this same obstruction is apt to lead to an infective process, as indicated by the fever, tachypnea, and tachycardia The truth is that even many postoperative atelectatic states are self-limiting, but, at the same time, many lead to pneumonitis, cardiac failure and death

Enzymatic Aerosols

There are various enzymes which aid in digestion or thinning of mucopurulent or mucoid secretions Some physicians have obtained good results with these agents The authors have not had sufficient experience with them to form a definite opinion However, it might be said that care must be taken in the use of these agents in that they are potent and occasionally cause allergic as well as marked irritation-type reactions Their use, in all probability, should be limited to specific patients in whom specific enzymatic therapy is indicated

Topical Anesthetics

Topical aerosol anesthetics have been administered and may in time be used much more widely than they are at present Primarily this technique is employed in preparation for bronchoscopy and bronchography

Function of the Suspending Gas

This has already been discussed An aerosol may be used to wet or make more effective a gas such as oxygen Air from a generator or electric compressor can be used to disperse aerosols, but at times it is the oxygen which is the all important agent in the therapy

NUTRITION

The maintenance of adequate nutrition for the patient in an intensive therapy unit will, in most instances, depend upon parenteral administration It should be emphasized that, as rapidly as possible and whenever feasible, nutritive substances should be taken directly into the gastrointestinal tract and preferably by the actual feeding per os There is no doubt but that the oral administration will allow more efficient utilization of most nutrients Occasionally, modified per os feedings can be given by use of a stomach tube or an orojejunal feeding tube Rarely, there may be instances in which feeding will be by the introduction of nutritive substances through a gastrostomy or jejunostomy stoma If the gastrointestinal tract is functioning, mixtures containing all of the essential nutrients can be delivered in a relative concentrated form and the correction of deficits, as well as the need for both daily requirements and extra-nourishment, can be met The parenteral administration of nutrients will usually fail to give an adequate caloric intake, which is so necessary to spare body proteins and thus maintain a nitrogen balance The introduction of foodstuff into the gastrointestinal tract will often stimulate a recovery of function of digestion, which in itself will hasten over-all recovery Substances such as Sustagen furnish an optimum formula for feedings in postoperative patients

process We believe aerosol therapy to be a part of the management of all tracheotomy patients

Wetting Action

If one places a slide wet with a 0 125 per cent solution of Alevaire, which contains a detergent wetting agent called superenone, and then places a slide wet with water beside the first slide, and drops a mucoid secretion on both, one sees how much less mucus adheres to the slide wet with the Alevaire

Also, if one makes a solution of methylene blue in water and another in Alevaire, or any substance containing a wetting agent, and then nebulizes these solutions onto a surface where the droplets can be seen, one will note that the "detergent" solution causes greater covering of the surface

It is our feeling that the use of wetting agents increases the surface action of any aerosol, aiding spread and diffusion into the secretions and increasing their effectiveness

Defoaming Aerosols

The work of Luisada has indicated that alcohol vapor is an effective agent against pulmonary edema We have been experimenting with various antifoam agents and found that ethyl alcohol, 10 and 20 per cent, as well as 2 per cent ethyl hexyl alcohol or octyl alcohol, and AF 5507-Y, an experimental solution containing 0 01 per cent silicone solution, 0 75 per cent superinone (an oxyethylated tertiary octylphenalformaldehyde polymer) 1 0 per cent glycerin, and 1 0 per cent potassium bicarbonate, is effective against experimental pulmonary edema Since only a few cases of pulmonary edema have occurred in our service, we do not have an adequate experience as yet, but in the three patients we have seen, the drug AF 5507-Y has worked very well Experimental work is progressing on the use of the defoaming agents to prove that they are valuable aids in the over-all management of the patient with pulmonary edema Alevaire should not be used as it may increase the foaming that takes place and do harm

Of course, treatment with antifoam agents should be combined with therapy with such agents as positive pressure oxygen, cardiac glucosides, sedation, blood when needed, and hypotensive drugs, such as Arfonad, when the blood pressure is extremely high All that can be said concerning the defoaming agents is that they are effective in decreasing the obstruction to respiration caused by the foam on the respiratory tract It is expected that the use of these agents will become standard practice in the next few years as they become more widely known and, therefore, accepted

plasma The electrolyte distribution in the body water compartments is as follows

Normal Body Electrolyte Concentrations

EXTRACELLULAR				INTRACELLULAR			
mEq /L plasma				mEq /L intracellular water			
Cations		Anions		Cations		Anions	
Na	142 0	Cl	104 0	K	150	HCO_3	10
K	1 5	HCO_3	29 0	Na	10	Cl	2
Ca	5 0	SO_4	1 5	Mg	40	HPO_4	88
Mg	3 0	HPO_4	2 0			Protein	80
		Org acids	2 0			SO_4	20
		Protein	16 0				

In examining the foregoing tables, it can be noted that there is an equilibrium between the acid and base electrolytes and if exact measurements could be taken the cations should equal the anions.

The units by which these electrolytes are expressed should be explained The unit is the milliequivalent The milliequivalent has replaced former expressions of electrolytes which generally were listed as milligrams per cent or volume per cent Milligrams per cent and volume per cent had no relationship as to the acid or base value of an electrolyte, and thus no direct comparison on such a basis could be made In body fluids there must be equilibrium or electroneutrality between cations and anions By expressing all electrolyte values in terms of milliequivalents one can readily visualize what discrepancy exists and replace or correct with an equivalent of what is deficient

If one molecular weight of sodium hydroxide is combined with one molecular weight of hydrochloric acid, then the solution will be neutralized because there are equivalent amounts of cations and anions A molar solution contains 1 gm molecule in 1 liter, e g , if one molecular weight of sodium hydroxide is (Na 23 0-OH 17 0) 40 gm and this is in a solution of water (liter), one has a molar solution A molar solution of sodium hydroxide is then equivalent (from the standpoint of producing electroneutrality) with a molar solution of hydrochloric acid These ions are all univalent It is obvious that a bivalent ion, such as calcium or magnesium, will, in the amount of one mole, have twice the combining power of a mole of univalent electrolyte Since the equivalent weight of an element is the amount in grams which will combine with or displace 1 gm of hydrogen, or its equiva-

The administration of nutrients parenterally may be much more complicated than the ordering of simple formulas, and the accurate administration may at times be lifesaving The essential components of nutrients are (1) water and electrolytes, (2) proteins, (3) carbohydrates, (4) fats and (5) vitamins These are all available for parenteral administration except fat, an adequate preparation of which is still not ready for routine use However, fat is actually the only one of the listed nutrients that, for a temporary period, is not absolutely necessary, partly because the body can for a time use its own fat

WATER AND ELECTROLYTES

The fact that most patients in an intensive therapy unit are unable to tolerate feedings per os makes it mandatory that adequate fluids to meet ordinary requirements be given by infusion In addition, many of the patients will have had excessive losses prior to their admission to the unit and the resulting deficit should be corrected With the recent advances in physiology, a greater awareness of the importance of these replacements has become evident Recovery of the patient may depend upon the proper maintenance of a cellular physiological state which is closely related to body water and electrolytes

Physiology of Body Water and Electrolytes

About 75 per cent of the body weight consists of water which contains variable electrolyte constituents For the physiological processes of the body to proceed normally, each component attempts to maintain a constant relationship of acid-base equilibrium by adjusting its positive or negative ions (electrolytes) In this shift of water and electrolytes, the cellular function is interfered with if correction is not made

The intracellular body water components make up 50 per cent of body weight and the extracellular, 20 per cent of body weight Plasma is a fraction of the extracellular water and it represents 5 per cent of body weight

Body Weight 70 Kg (154 Lbs)

Total water, 70%	= 49,000 cc	
Intracellular fluid, 50%	= 35 000 cc	ICF
Extracellular fluid, 20%	= 14 000 cc	ECF
ECF = Interstitial fluid 15%	= 10,500 cc	ISF
Plus intravascular fluid 5%	= 3,500 cc	IVF

The total body water is about 50 liters, of which 35 liters are intracellular water, interstitial fluid is about 11 liters and there are about 4 liters of

excesses If the concentrating power of the kidney is faulty, then it may require a much greater volume to rid the body adequately of these wastes and excesses (For more details of fluids in the presence of kidney disease, see Chapter 13)

The lungs serve to maintain the electrolyte equilibrium of the body by their capability of conserving or rapidly eliminating carbon dioxide and water The $\frac{H_2CO_3}{BHCO_3}$ ratio in the plasma fluid compartment is kept constantly at 20 1 by altering the respiratory rate to either eliminate excess carbon dioxide or retain it

A state of acidosis exists if there is an increase in anions Acidosis occurs commonly in association with diabetes, renal insufficiency and starvation In such states of acidosis, there is usually a decrease in plasma carbon dioxide to maintain the electroneutrality with a preservation of base In hyperventilation there may be a low plasma carbon dioxide with an actual alkalosis due to slow excretion of sodium

In alkalosis there usually is a relative deficit of chloride with a relative excess of sodium Alkalosis most commonly occurs in association with vomiting or after gastric suction

There is now a greater realization of the importance of potassium in the maintenance of water and electrolyte balance It is now realized that sodium may partially replace potassium in the cell, especially when there is an excess or relative excess of sodium or a deficit of potassium Potassium is excreted in the urine to conserve sodium and it is lost directly with vomiting, intestinal intubation, fistulas, diarrhea, and by similar means The kidneys have the ability to change their threshold for sodium whereby there may be either conservation or elimination, but the renal mechanism does not conserve potassium and therefore, in excessive urinary output, large quantities of potassium may be lost In the presence of oliguria, extreme caution is necessary in potassium therapy to avoid excess The plasma determination of potassium may not reflect the true state of the electrolyte balance, because there may be a marked intracellular deficiency with a relatively normal plasma level In cortisone therapy and in severe post-traumatic and postsurgical states, potassium tends to be lost via renal excretion, with preservation of sodium, whereas in adrenal insufficiency the reverse is true Potassium deficiency may be reflected in the electrocardiogram and manifested by cardiac arrhythmias, muscular weakness and paralytic ileus

Therapy in Water and Electrolyte Deficit

In planning therapy for patients needing water and electrolytes, especially if these substances are to be given parenterally, an estimation of

lent, it is equal to the atomic weight of an element divided by its valence As equivalent weights are larger factors than are usually present, the milliequivalent, which is one thousandth of an equivalent, is used The conversion formulas are as follows

$$\text{mEq/l} = \frac{\text{mg/100 cc} \times 10 \times \text{valence}}{\text{atomic wt}} \qquad \text{mg/100 cc} = \frac{\text{mEq/l} \times \text{atomic wt}}{10 \times \text{valence}}$$

$$\text{mM (or mEq)/l} = \frac{\text{vol \%} \times 10}{22\ 4} \qquad \text{Vol \%} = \frac{\text{mM (or mEq)/l} \times 22\ 4}{10}$$

All body fluids in their compartments maintain a balance between cations and anions By expressing and visualizing the electrolytes in terms of milliequivalents a visual or mathematical impression of a relative excess or deficit can be readily made Although one measures the electrolytes of the plasma fraction, one must constantly remember that each fluid compartment is involved in any disorder

The diet ordinarily contains an excess of water and electrolytes and the kidneys excrete the unneeded portion The gastrointestinal tract, lungs and skin help in ridding the body of any excess and conserve needed amounts

Approximation of Daily Obligatory or Physiological Water Loss

	cc
Urine	1000
Insensible (skin and lungs)	1500
Stool	100

When the plasma fluid compartment becomes deficient in either water or electrolytes, there is rapid interchange with the interstitial fluid, and recently it has become known that certain electrolytes can penetrate the intracellular fluid compartment, e g , if the cell is depleted of potassium, then sodium is capable of entering In general, there is little movement of sodium and potassium through cell membranes

There is no practical method at present to determine the electrolyte components of the body compartments except in the plasma fraction, although the interstitial fluid compartment is almost similar in normal states It should be re-emphasized that there is a constant interchange between all water compartments With an excess of water and electrolytes in the normal diet, a balance is maintained in all of the compartments between the intake of fluids and electrolytes and the output, which is primarily via the kidneys and also by the lungs, skin and gastrointestinal tract

The kidneys concentrate or dilute the urine as the need arises At least 500 cc of urine volume seem necessary daily to rid the body of wastes and

should be compared with the calculation based upon the history and physical examination, and the amount to be administered should be based upon correlation of both calculations, the total of which rests, in effect, upon clinical judgment

A determination of renal function, renal excretion rate and concentration must be simultaneously studied, since rapid replacement, especially potassium replacement, should not be carried out when renal insufficiency exists As a matter of fact, initially the electrolytes should be replaced slowly with an emphasis on the correction of dehydration The rapid replacement of calculated sodium loss is especially dangerous, since sodium is retained by the body during periods of stress

The following tables list the type of fluids commonly used and their electrolyte components expressed in milliequivalents

*Abbott's Electrolyte Replacement Solutions**

LIST NO		Na	K	Ca	NH_4	Cl	Lact	Mg	Cal
4450	IONOSOL® D CM	138	12	5		108	50	3	
4463	IONOSOL K w Inv Sug 10%	77	40			117			340
6403	IONOSOL D w Dext 10%	138	12			100	50		340
4479	IONOSOL D w Inv Sug 10%	138	12			100	50		340
6411	IONOSOL G w Dext 10%	63	17		70	150			340
4457	IONOSOL G w Inv Sug 10%	63	17		70	150			340
4148	IONOSOL PSL (Darrow's Mod)	121	35			103	53		
4136	Lactated Ringer's (Hartmann s)	130	4	2 7		107	28		
4134	Ringer's Solution	147	4	4 5		156			
4150	Sodium Lactate, 1/6 Molar	167					167		

$$\frac{\text{mg /100 cc} \times 10 \times \text{valence}}{\text{atomic wt.}} = \text{mEq /L}$$ Caloric value based on 3 4 calories/gm

*Abbott's Concentrated Solutions of Single Electrolytes**

LIST NO	ION-O-TRATE® SOLUTION	mEq /vial	Gm /vial	Av pH	Size
6646	Ammonium Chloride	100	5 35	5 5	20 cc
6651	Potassium Chloride	20	1 49	5 8	20 cc
6653	Potassium Chloride	40	2 98	5 8	20 cc
6670	Potassium Phosphate K^+ & HPO_4	=40		7 4	20 cc
6657	Sodium Chloride	50	2 92	5 8	20 cc
6660	Sodium Chloride	100	5 84	5 8	40 cc
6664	Sodium Lactate	50	5 6	6 5	20 cc
6668	Sodium Lactate	100	11 2	6 5	40 cc
6648	Dextrose 50% w/v			6 0	40 cc

* Abbott Laboratories

the deficit must be made Replacement of the loss and simultaneous administration of the daily requirement must be planned for

The amount of water and electrolytes to be given to correct the deficit is calculated, after a careful estimation has been made of the previous loss A careful record of all the excretions as to volume and content must be maintained A history of vomiting, diarrhea, fever, perspiration, loss via fistulas and the like allows one to calculate the deficit In severe diarrheas, 3000 to 5000 cc of fluid may be lost, in vomiting, 1000 to 3000 cc, and in patients with severe febrile states, 2000 to 4000 cc The following table reveals the electrolytes usually present in lost fluids

REPLACEMENT OF OTHER LOSSES must be in kind as measured Average contents in mEq /l follow

	Na	K	Cl	HCO_3
Gastric asp	35	12	150	0
Intestinal fluid	140	10	105	25
Bile	140	10	100	30
Pancreatic juice	140	10	75	75
Sweat	75	5	80	0

In addition, the normal daily requirement should be added The normal daily loss is about 1000 cc as urine, and about 1500 cc through the skin, lungs and stools

By the administration of water and electrolytes in the amount lost plus the daily requirement, one will crudely have approximated the present requirement This must be correlated with the actual physical findings and consideration given to the ability of the body to handle such replacement, making it a matter of clinical judgment

Simultaneous with the calculation of water and electrolytes required, based on history, physical examination and clinical judgment, one can also utilize laboratory determinations Plasma sodium, potassium chloride and carbon dioxide determinations are made If possible, blood volume studies are likewise carried out After these values are determined, total milliequivalent replacements based on body weight are calculated For example, if there is a total anion deficit of 20 mEq per liter of plasma and the patient weighs 70 kg, the need is 70–5 (since extracellular water represents 20 per cent of the body weight and the interstitial fluid is similar to plasma), or 14 liters of extracellular fluid x 20 mEq deficit per liter or 280 mEq of anion deficit If cation factors are not known, one can also assume that there is a similar cation deficit, since the body must maintain an acid-base equilibrium and vice versa Cation factors should, whenever possible, be determined independently and utilized

These laboratory determinations of the water and electrolyte needs

Amino acid preparations should be used whenever there is a deficit and when they can be employed as a constituent factor in the restoration of body fluids Parenteral administration of amino acids is indicated in those patients in whom protein depletion occurs, and in whom it is impossible to maintain ingestion and absorption of protein by the oral route Protein depletion may be brought about by malnutrition, chronic diarrhea, vomiting, intestinal obstruction and other gastrointestinal conditions, excessive loss of blood, loss of nitrogenous materials from wounds and burns, and greatly increased metabolism such as occurs in association with fever and thyrotoxicosis Amino acid therapy is often indicated in preoperative patients with hypoproteinemia in whom a positive nitrogen balance cannot be obtained by other means, and in postoperative patients in whom oral feeding is not possible, as in those having operations involving the gastrointestinal tract Hypoproteinemia may lead to edema and to reduced blood volume, a condition associated with malnutrition Low plasma protein levels may cause a lag in wound healing, and failure of healing of skin grafts Depletion of protein may predispose a patient to shock

The actual utilization of amino acid preparations by the body has been disappointing, and with the availability of plasma prepared by the method of Garrett Allen, in which consequential reactions, especially the development of serum hepatitis, seems to be reduced to a minimum, it is felt that plasma will often restore the level of plasma proteins to a greater and more effective degree In patients with a marked albumin deficit, both plasma and serum albumin should be used judiciously Except for minor reactions, the amino acid hydrolysates are a useful adjunct to the armamentarium of nutrient substances for parenteral use and should be available and utilized as necessary The gastrointestinal tract can, by physiological methods, prepare protein complexes that are more readily available for body usage, and, whenever possible, oral or tube feedings should be utilized to correct protein deficits

The carbohydrates are now available for parenteral usage in invert fructose forms, which give a greater availability and higher degree of utilization per unit of time of administration than does the commonly used 5 or 10 per cent glucose The simple administration of the carbohydrates in water or saline solution has been the mainstay of parenteral fluid therapy for years and has saved many lives By making carbohydrates available to the body, there is sparing of proteins and more complete metabolism of other nutrients In most instances, electrolytes or proteins should be replaced by employing infusions that contain carbohydrate, in order to obtain the maximum amount of caloric effect without overloading the body with fluids A concentration of greater than 10 per cent of carbohydrate in a liter

*Baxter Electrolyte Solutions**

SOLUTION	mEq per 1000 cc Na	K	Ca	Cl	Lactate	NH_4	Mg	HPO_4	Carbohydrate	Route of Admin.
Modified Duodenal Solution	80.0	36.0	4.6	63.0	60.0	—	2.8	—	—	Any
Travert 10% Electrolyte No 1	80.0	36.0	4.6	63.0	60.0	—	2.8	—	Travert 10%	Any
Travert 10% Electrolyte No 2	57.0	25.0	—	50.0	25.0	—	6.0	12.5	Travert 10%	Any
Travert 10% Electrolyte No 3	63.0	17.5	—	150.5	—	70.0	—	—	Travert 10%	Any
Ammonium Chloride 2.14	—	—	—	400.0	—	400.0	—	—	—	IV
Darrow's	121.0	35.0	—	103.0	53.0	—	—	—	—	Any
M/6 Sodium r Lactate	167.0	—	—	—	167.0	—	—	—	—	Any
Travert 10% Potassium Chloride 0.3% in Water	—	40.0	—	40.0	—	—	—	—	Travert 10%	Any
Travert 10% Potassium Chloride 0.3% in 0.45 NaCl	77.0	40.0	—	117.0	—	—	—	—	Travert 10%	Any

$$\frac{\text{Milligram/100 cc.} \times \text{valence} \times 10}{\text{atomic weight}} = \text{milliequivalent/liter}$$

* Baxter Laboratories Inc.

*Baxter Electrolyte Solutions**

SOLUTION	Grams per 100 cc. NaCl	KCl	CaCl	Na r Lactate	NH_4Cl	MgCl	K_2HPO_4	Carbohydrate	Route of Admin.
Modified Duodenal Solution	0.117	0.268	0.034	0.672	—	0.028	—	—	Any
Travert 10% Electrolyte No 1	0.117	0.268	0.034	0.672	—	0.028	—	10.0 Travert	Any
Travert 10% Electrolyte No 2	0.18	0.100	—	0.28	—	0.03	0.115	10.0 Travert	Any
Travert 10% Electrolyte No 3	0.37	0.13	—	—	0.374	—	—	10.0 Travert	Any
Ammonium Chloride 2.14	—	—	—	—	2.14	—	—	—	IV
Darrow's	0.40	0.26	—	0.59	—	—	—	—	Any
M/6 Sodium r Lactate	—	—	—	1.866	—	—	—	—	Any
Travert 10% Potassium Chloride 0.3% in Water	—	0.30	—	—	—	—	—	10.0 Travert	Any
Travert 10° Potassium Chloride 0.3% in 0.45 NaCl	0.45	0.30	—	—	—	—	—	10.0 Travert	Any

* Baxter Laboratories, Inc.

PROTEINS, CARBOHYDRATES AND FATS

In the intensive therapy unit, protein preparations are available for parenteral administration, as whole blood, serum plasma and other fractions of whole blood, such as albumin or packed cells, as well as the hydrolysates or amino acid preparations The correction of acute deficits is, of course, accomplished by the use of whole blood or one of its components The authors feel that ample correction of acute deficits is made when blood or one of its fractions is employed, but that the use of these substances as nutrients when an actual deficit does not exist is unwarranted There are still too many reactions, some of which are fatal, to warrant the use of blood without specific indication

Emergency patients brought into the recovery room should have an optimum amount of vitamins both to correct the deficit and provide the daily requirements The approximate optimum intake is as follows

Ascorbic acid (vitamin C)	1 gm
Thiamine	50 mg
Riboflavin	50 mg
Niacin	500 mg
Vitamin K	10 mg (10 mg given intramuscularly or intravenously two to three times daily)

Vitamin K (vitamin K_1), in ampules of 72 mg, should be given to any patient who is bleeding excessively in whom there is any suspicion of a hypoprothrombinemia

Since most of the patients in the recovery room require parenteral administration of vitamins, it is a good general routine measure to add an ampule of vitamin B complex, 1 gm of ascorbic acid and 10 mg of vitamin K to each intravenous infusion, or at least to one intravenous infusion daily

TUBE FEEDINGS

The placing of feeding tubes in the gastrointestinal tract at the time of surgery is becoming increasingly common Several tubes have been introduced that allow stomach evacuation and simultaneous feeding through a second lumen that extends on into the jejunum These double-lumen tubes for upper gastrointestinal surgery are described in Chapter 9 Jejunostomies performed for early direct feeding in the poorly nourished patient are not too uncommon, especially when extensive upper abdominal surgery is undertaken The recovery room may have a number of seriously ill patients who have not had surgery but who will benefit by tube feedings

The newer plastic tubes cause less irritation to the mucosa of the gastrointestinal tract than did the older-type tubes If these tubes are properly lavaged to prevent clogging they may be used for long periods without harm Although most patients do not spend many days in the recovery room, it should be mentioned that plastic feeding tubes have been utilized over many weeks without undue injury Any tube in the nasopharynx, however, causes considerable psychic reaction and tends to immobilize the patient, therefore long periods of tube feeding should be avoided if proper nutrition can be obtained by direct feeding

Initially, after surgery, especially if ileus resulting from surgical trauma is expected, it is best not to introduce complex formulas through feeding tubes The authors like to start tube feedings by giving a flask of plain glucose and water which can be attached to the intravenous tube by

of fluids should not be used, not only because of the danger of superficial thrombophlebitis, but also it is known that the body cannot utilize this compound to an optimum advantage in greater concentrations, i e , carbohydrate is lost through the kidneys, carrying with it water and electrolytes, causing dehydration and, further, may directly damage the kidneys

Because of extreme protein losses during all phases of body stress, preoperatively, during surgery and postoperatively, every attempt must be made to maintain a positive nitrogen balance Postoperative complications, especially those related to poor healing, might be reduced if adequate proteins could be administered and these could be efficiently utilized A minimum of 1 gm of protein per kilogram of body weight should be available to the body, and, if possible, greater quantities, especially when there is marked tissue destruction or suspected deficit The carbohydrates not only serve to maintain caloric intake, but are equally important in their protein-sparing action

Parenteral fat administration is still in the experimental phase Its advantage would be to furnish caloric requirements, sparing the depletion of nutrient depots from the body

VITAMINS

Vitamins are given postoperatively to correct any deficit, to maintain normal levels, and, in certain instances, e g , for hypoprothrombinemia, as specific therapy

Vitamin C deficiency has been shown to be associated with delayed wound healing and it is therefore mandatory in surgical patients to maintain an adequate vitamin C level Vitamin K deficiency produces a hypothrombinemia which increases the risk of bleeding and wound hematomas Therapeutic doses of vitamin B complex should be administered during periods of increased metabolic activity

Many patients brought to the recovery room have had poor nutrition and suffer a chronic vitamin deficiency When there is ample time preoperatively, it should be routine to correct any deficits At least a normal daily intake should be prescribed prior to surgery, this is approximately as follows

Vitamin A	5000 units
Vitamin D	400 to 800 units
Thiamine (B_1)	2 mg
Riboflavin	3 mg
Niacin	20 mg
Vitamin C	75 mg
Vitamin K	10 mg (10 mg given intramuscularly will allow the prothrombin time to reach a maximum in 6 to 16 hours if the liver is normal)

Chapter 4

NEUROSURGERY

OSCAR SUGAR, M D

THE RECOVERY ROOM AND INTENSIVE THERAPY UNIT is of particular interest to the neurosurgeon because it allows centralization of postoperative care and intensive watching which otherwise is possible in most hospitals only with patients attended by private duty nurses The intensive therapy unit may also be used for patients having acute head injury without operation, for those in the acute phase following spinal cord injury, and for patients in myasthenic crisis and for others in similar acute states

Aside from the general principles of postoperative care, there are problems which are peculiar to neurosurgery because of the existence of a closed space in which operation has been performed (cranium or spinal canal), which implies that tolerance of bleeding and swelling is quite restricted Furthermore, the operations done frequently involve areas of the central nervous system which have to do directly with the breathing mechanism, temperature control, or control of the circulation Hence, the special problems of neurosurgical postoperative care involve recognition of increasing pressure within the calvaria or the spinal canal In the conscious patient the problem is less difficult than in the unconscious In a patient who has had an operation performed within the cranium, probably the earliest sign of increasing intracranial pressure due to cerebral edema or bleeding is change in the state of consciousness, the patient who has been alert becomes drowsy and has to be aroused before answering After an operation upon the spinal canal a patient who has been able to move his toes and feel position change in the lower extremities has difficulty in performing set tasks or in feeling painful or other stimuli in the areas below the level of operation Therefore, in the conscious neurosurgical patient, it is necessary to check, at intervals of thirty to sixty minutes, the level of consciousness and the ability to move the peripheral portions of the body Such patients also

inserting the intravenous tubing directly into the feeding tube By first using a simple solution, such as glucose and water, there is early stimulation of peristalsis without the necessity of the body performing complex digestive functions The first feeding should be performed slowly, and if there is distention or indication of gastric dilatation, the fluid feeding can be terminated and suction instituted without the possibility of plugging of the tubing Generally, these early feedings will effect an early return of peristalsis and then the daily fluids and other nutrients can be introduced through the feeding tube, eliminating the need for intravenous infusions Gradual stepping up of the complexity of the tube feeding should then be undertaken Clear broth made from strained meat juices will furnish a good quantity of electrolytes and is tolerated well A skim-milk mixture should then be used and, if this is tolerated, a homogenized milk product plus amino acids and vitamins, with the addition of potassium chloride, will furnish most of the essential nutrients Further progression of complex feedings can be gradually introduced until a high caloric, high protein, high vitamin and high mineral mixture is being given In the authors' experience the tendency is to push tube feedings too fast and this will usually result in cramping, nausea and diarrhea If marked gastrointestinal activity occurs, the simple solutions should again be used and, if necessary, paregoric or tincture of opium should be introduced into the feeding mixture When any milk product is used, and, as a matter of fact, when any type of large food particle is introduced into the tubing, the tubing must be lavaged every thirty minutes by flushing it with water or saline solution Too slow a drip will also allow curd formation and precipitation, which may cause plugging of the tube

A Murphy drip attached to a salvarsan bottle will allow proper visualization of the rate of feeding The rate must be rapid enough to prevent clogging of the tubing and yet must not be so rapid as to cause symptoms of fullness The rate, therefore, varies with the patient and the type of illness After peristalsis has returned, at least a liter an hour should be given unless the feeding is a highly complex one

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OSCAR SUGAR, M D

THE RECOVERY ROOM AND INTENSIVE THERAPY UNIT is of particular interest to the neurosurgeon because it allows centralization of postoperative care and intensive watching which otherwise is possible in most hospitals only with patients attended by private duty nurses The intensive therapy unit may also be used for patients having acute head injury without operation, for those in the acute phase following spinal cord injury, and for patients in myasthenic crisis and for others in similar acute states

Aside from the general principles of postoperative care, there are problems which are peculiar to neurosurgery because of the existence of a closed space in which operation has been performed (cranium or spinal canal), which implies that tolerance of bleeding and swelling is quite restricted Furthermore, the operations done frequently involve areas of the central nervous system which have to do directly with the breathing mechanism, temperature control, or control of the circulation Hence, the special problems of neurosurgical postoperative care involve recognition of increasing pressure within the calvaria or the spinal canal In the conscious patient the problem is less difficult than in the unconscious In a patient who has had an operation performed within the cranium, probably the earliest sign of increasing intracranial pressure due to cerebral edema or bleeding is change in the state of consciousness, the patient who has been alert becomes drowsy and has to be aroused before answering After an operation upon the spinal canal a patient who has been able to move his toes and feel position change in the lower extremities has difficulty in performing set tasks or in feeling painful or other stimuli in the areas below the level of operation Therefore, in the conscious neurosurgical patient, it is necessary to check, at intervals of thirty to sixty minutes, the level of consciousness and the ability to move the peripheral portions of the body Such patients also

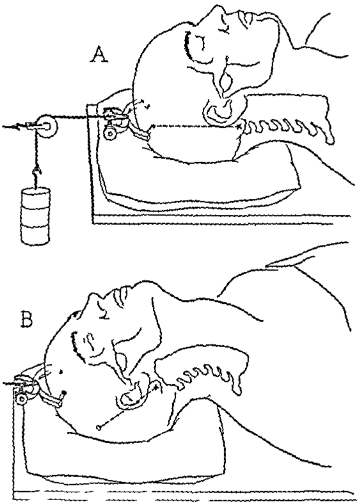

Fig 1 Crutchfield tong for head traction for patients having cervical spine injuries A, Correct application, B, incorrect application

can be asked to move the parts of the body or to identify various sensations, or to state spontaneously if there is some perversion of sensation or loss of sensation of a subjective nature Unfortunately, however, most neurosurgical patients are taken to the recovery room in an unconscious state or with a lowered level of consciousness, and reliance must, therefore, be put on accessory methods of determining intracranial and intraspinal function

VITAL SIGNS

It is customary to record the vital statistics at frequent intervals in the unconscious patient, hoping thereby to detect changes which are of major importance The pulse rate, blood pressure reading and respiration rate should be noted and recorded every fifteen to thirty minutes for the first two or three hours, and then every sixty minutes for another four to six hours, and thereafter at four-hour intervals Changes in vital signs due to

intracranial complications may occur in either direction It is customary to believe that a fall in pulse rate and a rise in blood pressure with Cheyne-Stokes respiration are indicative of increasing intracranial pressure, and this may well be the case, particularly when swelling or collections of blood are present in the anterior two thirds of the cranium These are, however, late signs and may well be absent For instance, in patients with bleeding into the region of the fourth ventricle following operations on the cerebellum or fourth ventricle, the pulse rate may become more rapid and the blood pressure fall to levels of 90 or lower If the meaning of this fall is not recognized, the patient may be treated merely for blood loss and shock, while the clot in the posterior fossa kills the patient In infants, bleeding into the spaces around the brain may involve sufficient blood loss actually to cause shock by exsanguination It is perfectly proper to treat the patient for blood loss or shock, but the neurosurgeon must also be notified and reoperation considered

Occasionally the blood pressure will be lower than normal as a result of induced and controlled hypotension for the purpose of diminishing the bleeding during operation This is particularly apt to occur if the drug used is a long-acting one (such as hexamethonium) If such a drug has been used, it should be so noted by the attending surgeon so that undue alarm will not be felt. Particular care must be used in such patients in reporting even slight drops in blood pressure, elevations in pulse rate, depressed respiration, or change in color of the skin, so that appropriate measures may be instituted immediately

FEVER

The chemical meningitis which often results from the spillage of blood into the spaces around the brain or spinal cord is often sufficient to produce hyperthermia, but fever after operation is common and is quite variable in its extent Temperature should be taken whenever possible by use of a rectal thermometer and active measures to combat fever should be instituted when the temperature rises more than 2° C or more than 3° F Aspirin by rectum is a very effective drug given in doses of 1 gm (15 grains) for adults and proportionately lower doses for children Perhaps the most effective antipyretic measure is the cooling of the body surface induced by evaporation of alcohol The usual alcohol rub or sponging is quite inadequate for antipyretic purposes To obtain maximum cooling a large area must be exposed at one time, and the contact between alcohol and body must be intimate This is best accomplished by soaking large gauze squares in alcohol and spreading these out over the nude extremities and trunk As soon as the first ones are dried, they should be removed and fresh ones

applied There is little benefit from using alcohol-soaked bath towels, for these do not permit access of the air to the skin to allow evaporation Alcohol solutions may be iced, or it may even be proper to hasten evaporation by having a fan blow across the alcohol-draped body

Chlorpromazine and allied drugs may also be given to aid in reducing temperature elevation

RESPIRATION

With impairment of breathing, possibly from the neurosurgical procedure or its sequelae, it becomes necessary to provide an adequate airway This is especially true since hypoxia and carbon dioxide retention tend to cause vasodilatation and cerebral edema, which in turn accentuate the changes already present An unconscious patient does best if not allowed to lie on his back in a semi-sitting position, even if an airway is in place Lying on one side or even on the abdomen, with the head to one side, is preferable If respiratory obstruction persists in spite of adequate oropharyngeal cleaning, tracheotomy may be performed It should not await impending death Respiratory inadequacy is often a problem following operations on the cervical spinal cord or in patients with myasthenia gravis, resort to an artificial respirator ("iron lung") should not be delayed in such patients with diaphragmatic or intercostal immobility Especial watchfulness is required following cerebral angiography, because of bleeding into the neck or extravasation of dyes used for injection (See section on respiration)

POSITION

Position becomes important not only for proper respiration, but also for prevention of the two major complications of immobility bronchopneumonia and decubitus ulcers Turning an unconscious or paralyzed patient every two hours allows expansion of the lungs beyond that which is permitted by allowing the patient to remain undisturbed Decubitus ulcers are always difficult to treat, and are best avoided Protein and mineral metabolism are usually disturbed in paraplegic patients, and are often disturbed in comatose patients, but, even so, the major cause of decubitus ulcers is pressure If this can be distributed equally, or at least relieved for several hours at a time, the formation of the sores may be avoided The use of a Stryker frame (or two litters with holes cut out for face and buttocks) can easily make the difference between good skin care and bedsores Pressure is more apt to cause breakdown of the skin if the area is wet than if it is dry, consequently, control of bladder and bowels becomes important here as well as in general care of the patient

In order not to have too much movement of the patient, he should be

transferred from the operating table directly into his bed, and not to a cart and thence to bed A patient with head dressings should be placed so that *his head is at the foot end of the bed, allowing easier access for dressing* changes, stitch removal and the like

BOWEL AND BLADDER CARE

Ordinarily, bowel attention is not important in the recovery room stage of patient care except when a proctoclysis has been ordered The slow rectal infusion of 200 to 300 cc of a 25 per cent saturated solution of magnesium sulfate is used to reduce intracranial pressure by withdrawing tissue fluids into the blood stream and thence onto the colon The Mg^{++} ion probably also exerts a sedative effect on neural tissues Dehydration *through the rectal infusion of magnesium* sulfate may also be of value in the preoperative care of neurosurgical patients The evacuation of such a proctoclysis is usually involuntary, but should be planned for, using rubber sheets, absorbent newspaper, and similar material

Bladder care is dependent on the neurological status of the patient. In patients subjected to operations on the spinal canal, urinary retention may be transient (as after disc removal) or long-lasting If the latter is probable, an indwelling urethral catheter attached to a tidal drainage apparatus had best be used immediately Some urologists prefer suprapubic drainage, but this is usually not carried out during the recovery room period Usually, catheterization every eight hours is adequate if the patient is expected to regain bladder control within the next day or two Catheterization is often an effective measure in calming an irrational or semistuporous patient having a head injury (for such patients may be taken to the recovery room if in apparently critical condition)

SEDATION

Sedation of neurosurgical patients is based on the concept that important changes must not be masked Usually, aspirin alone is used for relief of headache in patients with head injury or head operations, lest a sedative or narcotic mask signs of increasing intracranial pressure The principal difficulty arises when the patient becomes confused or wild and must be kept quiet Usually the confused or wild state is due to blood in the subarachnoid space or contusion of the brain Occasionally it is due to a full bladder, and therefore catheterization should always be attempted before using sedatives The judicious use of arm and leg restraints may be adequate, ordinarily, restraint of one arm and the opposite leg will be enough If full restraints are needed, they should not be so applied as to keep the patient constantly on his back, but position changes should be encouraged Fre-

quently the mere presence of an attendant, to sit with a patient or hold a hand, is enough to allay restlessness If, however, these measures do not suffice, sedation may need to be given Paraldehyde (8 cc by rectum or mouth) or chloral hydrate (0 5 to 2 gm , by mouth or rectum) is the safest, for neither of these drugs depresses respiration excessively, nor is the depth of sleep so great that the patient will not respond to painful stimulation The intramuscular (*deep*) administration of paraldehyde is occasionally necessary, but is too dangerous for ordinary use If paraldehyde or chloral hydrate is ineffective, it may be necessary to give barbiturates (Amytal, Nembutal, Pentothal) intravenously The urgency of quieting the patient should not lead one into the dangerous practice of giving 0 5 to 1 0 gm of Sodium Amytal intravenously in one rapid injection The dose of barbiturate is that which suffices to quiet the patient, more is unnecessary and dangerous Hence the injection (with temporary manual restraints) should be slow and discontinued once the patient is quiet, paraldehyde or chloral hydrate, administered rectally, may then be added Restlessness may also be a sign of hypoxia, for which reason oxygen by nasal catheter (with the arms restrained) may be of value

*The same considerations described above should also govern the treat*ment of the patient with status epilepticus Only enough medication to stop the recurring fits should be given This is supplemented by the rectal administration of Dilantin (0 1 to 0 3 gm), which is facilitated by puncturing the ends of the capsules or emptying them into water which is then instilled

Pain from operations on the spine is usually much more intense than that from craniotomies, and morphine (10 to 15 mg) or Demerol (75 to 150 mg) may be used

DEHYDRATION

When complications are recognized by careful postoperative watching and testing, certain procedures may be carried out while the patient is in the recovery room—either as definitive or as temporizing treatment The increasingly comatose patient may be given 25 to 100 cc of 20 to 50 per cent solution of glucose (or hypertonic sucrose or albumin solution) intravenously This causes a prompt dehydration and shrinkage of the brain which may give enough time to prepare the patient for operation, if this is indicated This method of hydration it not to be used routinely in combating increased intracranial pressure for its effects are transient and the "rebound" following may give a greater pressure than before Administration of diuretics (aminophylline, 250 mg in 10 cc of solvent given intravenously or 500 mg in 2 cc of solvent given intramuscularly) may then be of value Intravenous hypertonic therapy may be combined with a magnesium sul-

fate proctoclysis to rid the body of the water which has been extracted from the brain (and other organs)

SPINAL AND VENTRICULAR PUNCTURE

Ventricular puncture may be lifesaving, for it produces an immediate decrease in intracranial hypertension It is available, of course, only when access to the ventricles has already been provided by properly placed bur holes A sterile ventricular needle should always be available in a recovery room to which craniotomy patients are sent The dressings are removed, the wound is swabbed with alcohol, and the needle inserted between the stitches, toward the ventricle A gush of air or fluid indicates success At times the needle (or a flat-topped T-cannula) may be left in place to allow drainage to continue

Spinal puncture is more rarely indicated than ventricular puncture to relieve pressure, or to allow withdrawal of bloody cerebrospinal fluid, in a craniotomy patient, in whom adequate cerebral decompression is already available Spinal puncture may be performed in the recovery room when progressive sensory or motor dysfunction occurs in a patient who has had an operation on the spinal canal A manometer should always be used to measure pressure whenever a spinal puncture is done Only when a block is suspected is it proper to perform Queckenstedt's maneuver (compression of the jugular veins) to see if there is free rise and fall of fluid in the manometer The spinal needle should be inserted below the level of the second lumbar spinous process An interspace just above or just below a line drawn between the iliac crests is safest The puncture should be done with the patient in the lateral decubitus instead of in sitting position, and it may not be wise to try to flex the spine if there is possibility of thoracic or abdominal trauma, or it may not be possible if the patient is very restless (as after subarachnoid hemorrhage) After the needle has been inserted it must then be directed cephalad if the lumbar curve is in a lordotic position Cisternal puncture should not be attempted in a restless patient If manometry is important, one should always wait a few minutes after the needle is in place, to allow the patient's excitement to decrease

DRAINAGE

There is a growing use, in some quarters, of drains to allow seepage from large cavities (as after large brain resections) These drains may be left in during the first twenty-four to forty-eight hours to allow the patient to become more conscious Because of drainage the dressings may become blood-stained and wet If this occurs, the dressings should be reinforced or changed, not only for esthetic reasons, but to diminish the possibility of

contamination Dressings in any area should be inspected frequently, especially if there is evidence of falling blood pressure

Occasionally, as a consequence of operation, but more often after head injury, there may be seepage of cerebrospinal fluid from the nose or ear This is to be permitted to continue, preferably by placing the draining area lowermost Plugging the orifice with cotton is to be avoided, for this permits pooling of fluid which serves as a good culture medium for omnipresent bacteria Determination of the presence of cerebrospinal fluid when there is bleeding from these orifices may be made by observing the pool of blood on the bedclothes If cerebrospinal fluid is present there will usually

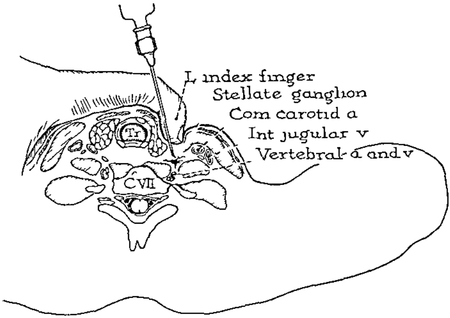

Fig 2 Cross section of neck at seventh cervical segment Anterior approach for stellate ganglion procainization

be a clear wet area surrounding the bloody stain Spinal puncture is particularly contraindicated in patients with such leakage, for the outpouring of fluid, washing microorganisms away, would then cease Nose-blowing is also to be avoided as much as possible

VASODILATOR THERAPY

The role of sympathetic paralysis in the treatment of acute cerebral ischemia is not yet settled, but at least some patients seem to be aided by its induction Certain patients with weakness following cerebral angiography, or following carotid ligation, especially seem to be benefited Stellate ganglion paralysis may be induced in the hope of increasing blood flow to the brain The preferred approach is an anterior one in which 10 cc of

1 or 2 per cent solution of procaine are injected against the sixth or seventh cervical transverse process, permitting downward diffusion of the drug to the ganglion (Fig 2) Aspiration before injection is always indicated, lest injection be made into a vertebral vessel Carbon dioxide inhalations and injections of papaverine (0 1 to 0 2 gm) may also be used for vasodilatation If cerebral ischemia is indicated by paresthesia, weakness, or hemianopsia following carotid ligation, immediate removal of the ligature may be indicated, and this is an emergency bedside procedure for which an emergency tray should be available

X-RAY EXAMINATION

It is infrequently important to have immediate x-ray films of the skull after head injury Most of the time, sufficient information for deciding about operation comes from clinical observation When films are necessary, they usually may be obtained in the recovery room, using a portable x-ray apparatus and film cassettes incorporating fine grids Special electrical conduits and portable x-ray machinery should be incorporated in the equipment of the recovery room, for thus, exposures shorter than those obtained with conventional apparatus can be made with proportionately better films, especially in restless or semi-stuporous patients An anteroposterior view and both lateral views can be had without twisting or turning the patient's head, and these usually suffice for emergency use

POSTOPERATIVE ORDERS

The following orders for postoperative and post-trauma care should be considered as guides only, obviously, the circumstances of each case may invalidate some and add others Currently accepted abbreviations will greatly reduce the bulk of the writing

Craniotomy

In general the orders are intended to warn of increasing intracranial pressure, as with hemorrhage or edema Pain is rarely extreme, and sedation is contraindicated

1 Pulse rate, blood pressure reading and respiration rate recorded every fifteen minutes for two hours, every thirty minutes for two hours, every hour for four hours or until the patient awakens, then every four hours Call resident if blood pressure falls as low as 90 systolic or rises above 150 systolic, if respiration becomes periodic (Cheyne-Stokes), or if pulse rate goes below 70 or above 140 *

* These levels of warning vary according to the preoperative figures, age of patient, induced hypotension, blood loss, etc

2 Temperature (rectal) recorded immediately and every four hours, if it rises above 103° F (or 39° C), give aspirin by rectum (1 0 gm for an adult) and alcohol bath until temperature falls to at least 101° F or 38° C
3 Have patient on side or abdomen with head turned, no pillow or elevation of back rest until patient is conscious and his blood pressure is stabilized
4 Aspirate nasopharynx as indicated by noisy respiration
5 Continue fluids which were started in the operating room and add 5 per cent dextrose in water to give an intake of 2000 cc more than was lost during operation Add vitamin B complex (e g, "Solu-B" with ascorbic acid) to each bottle of fluid
6 Catheterize patient every eight hours if necessary, if unconsciousness or incontinence is prolonged more than twenty-four hours, use indwelling catheter
7 Fluids by mouth when patient is conscious, unless he is nauseated
8 Aspirin (0 6 gm) by mouth every three hours as needed for headache
9 If dressing becomes blood-soaked, reinforce with sterile dressings and call resident

Other orders which might be needed, depending on surgeon and operation, include

10 Proctoclysis, of 300 cc of 25 per cent saturated solution of magnesium sulfate, to run in during one to two hours
11 If patient has a postoperative convulsion or had convulsions before operation, call resident and give Dilantin, 0 2 gm by rectum with 0 1 gm to follow thrice daily (rectally until oral use can be started)
12 Penicillin given intramuscularly, 600,000 units daily, for three days
13 Have sterile ventricular needle at bedside

Laminectomy

Besides the usual measures for postoperative care, especial watch is needed to permit warning of increasing swelling or bleeding within the spinal canal Bowel and bladder care, and the avoidance of decubitus ulcers are of special interest. The same general orders are used following possible injuries to the spine

1 Pulse rate, blood pressure reading, and respiration rate are recorded every fifteen minutes for two hours, every thirty minutes for two hours, and every hour until patient awakens, then every four hours

Call resident if blood pressure falls to or below 90 systolic or pulse rate is outside the range of 70 to 140, call if there is cyanosis or difficult respiration

2 Rectal temperature recorded every four hours If it rises above 103° F (39° C), give aspirin (0 5 gm by mouth, or 1 0 gm by rectum) and bathe patient with alcohol until temperature falls to at least 101° F or 38° C

3 Turn patient from side, to back, to side, every two hours, keeping spine correctly aligned at all times ("logwise") Prop in position with pillows

4 Continue fluids already started and add 5 per cent dextrose in water* to give an intake of 2000 cc more than was lost. Add vitamin B complex (e g , "Solu-B" with ascorbic acid) to each bottle of fluid

5 Indwelling catheter, if patient does not void in eight hours †

6 Fluids and soft diet as tolerated after nausea

7 Morphine sulfate (1/6 grain, or 0 01 gm) by hypodermic injection on awakening with severe pain, and every four hours as needed thereafter

8 If dressings are saturated with blood, reinforce with sterile dressings and call resident

9 If bed is wet or wrinkled, replace bedclothes with dry ones Notify resident if red pressure areas appear

10 When patient is awake, check and record movement and pin perception in all four extremities every hour

Additional orders may include

11 Penicillin, 600,000 units, given intramuscularly daily for three days

12 Have artificial respirator available (for patients having high cervical laminectomy)

13 If patient is irrational and restless, give oxygen intranasally (5 liters per minute) or put in oxygen tent

14 Mineral oil (30 cc) daily for three days, then soapsuds enema if there has been no bowel movement before then

15 When patient is awake, flex and extend knee and hip every time he is turned

16 Have bed board put under mattress, if not already there

* If laminectomy is a part of a ureterostomy for hydrocephalus, use dextrose in saline (to replace chloride lost from cerebrospinal fluid drainage)

† If patient is paraplegic or expected to be start Munro tidal drainage

Head Injury

Observation is needed to warn of rising intracranial pressure, and nothing is done which may interfere with this observation In general, shock is treated first, then associated chest and abdominal wounds, then extremity fractures, then head injury

1 Awaken patient hourly and make him respond (verbally if possible) If necessary, apply painful pressure to the supraorbital notch or styloid processes under the ears If patient's response is slower than before, or if he is unresponsive, call resident at once
2 Record blood pressure reading and pulse and respiration rates every half hour for four hours, then hourly until patient awakens, then every four hours Call resident if systolic blood pressure rises or falls 20 mm or more, if respiration becomes irregular, or if pulse rate goes below 70 or over 140 per minute
3 If pupils become unequal in size or fail to respond to light, call resident immediately Check every time patient is awakened
4 Bed flat, with patient turned side to side every two hours while unconscious
5 Aspirate secretions as indicated by noisy respiration
6 Temperature (rectal) recorded every four hours Aspirin (1 0 gm) by rectum and alcohol bath for temperature over 103° F or 39° C
7 Nothing by mouth, unless patient is fully awake and not nauseated.
8 No x-ray examination, unless specifically ordered.
9 If patient is restless, catheterize, and repeat in eight hours if there has been no interim voiding
10 Bed rails up, restrain one arm and opposite leg if patient tries to get out of bed Change position of patient and restraints every two to four hours

Additional orders which may be needed include

11 Penicillin, 600,000 units every two hours intramuscularly (if there is cerebrospinal fluid leak)
12 Do not plug bleeding ear or nose, and permit bleeding ear to be nearest bed
13 If patient has a convulsion, make sure airway is properly placed in mouth, call resident, and give Dilantin, 0 2 gm, by rectum
14 Make sure tetanus toxoid or antitoxin has been given in admitting room or give now
15 Give 8 cc. of paraldehyde by rectum if patient is overly active in spite of restraints or is disturbing other patients

16 Watch for clear wet area around sheet under bleeding ear or nose, as sign of cerebrospinal fluid leak
17 In infants, palpate fontanelle every hour and call if it becomes tense

Carotid Ligation

This involves possible ischemia of the brain and use of anticoagulants to prevent ascending thrombosis

1 Watch for bleeding into the neck, if swelling occurs, call resident
2 Make patient wiggle fingers and toes on side opposite to neck incision every fifteen minutes for two hours, every thirty minutes for four hours, then hourly for twenty-four hours If unable to do so, if peculiar sensations appear, or if speech is difficult, call resident and get ready tray for stellate block and tray for opening incision
3 Clotting time daily recorded, with Dicumarol dosage to be determined after report is available
4 Send urine specimen daily to laboratory for microscopic study for blood cells
5 No narcotics for first twenty-four hours
6 Cold compress to neck

Cerebral Angiography

The complications of importance here are cerebral swelling, reaction to contrast material, bleeding in the neck, and respiratory distress When angiography has been performed with the patient under general anesthesia, orders 1 through 4 under *craniotomy* are repeated

Additional orders may include

1 Papaverine, 0 2 gm (3 grains) given intramuscularly now, and 0 1 gm ($1\frac{1}{2}$ grains) every four hours until the patient is awake, then by mouth
2 If patient has new weakness of one side, call resident and get tray for stellate block
3 Magnesium sulfate proctoclysis (300 cc of 25 per cent saturated solution) to run in for one to two hours
4 Benadryl, 50 mg given intravenously (if there are hives following use of Diodrast or other contrast medium)
5 Ice collar to neck, if there has been bleeding
6 Steam inhalator, for respiratory distress following intubation
7 Have tracheotomy set and respiratory aids placed at bedside for use if respiratory obstruction develops

Chapter 5

SURGERY OF THE EYE

MAURICE D PEARLMAN, M D

RECOVERY ROOM PERSONNEL in a modern hospital can help the eye department materially while attending certain postoperative eye patients by (1) carefully handling these patients so as to prevent any damage to the eye area, and (2) being alert to recognize signs of complications appearing during the recovery room stay This chapter is addressed to recovery room personnel without special training in or knowledge of ophthalmic surgery and nursing care who will want general guidance in the care and handling of eye patients

Actually, a small percentage of eye patients requires recovery room care because most of the patients undergo relatively simple regional (retrobulbar) anesthesia and are selected or pretreated carefully so as to be free of serious general disorders However, the seriousness of the condition of the few who do require such care will range from syncope preventing immediate leaving of the hospital following the simple removal of a surface cinder to the state of shock resulting from the removal of an intraocular foreign body under general anesthesia

Surgical eye patients are unique in two specific regards, among others First, they are tautly anxious and apprehensive because the eye and its sight are so important that both minor and major eye problems cause equally great concern This concern should be allayed by considerate, compassionate and encouraging attention Second, they have undergone surgery on tissues so delicate, relatively small and irreplaceable that any trauma which causes damage postoperatively may result in profound visual loss This second regard emphasizes the reason why special care is needed

INSTRUMENTS, DRESSINGS AND MEDICATION

A portable and compact eye tray containing some essential instruments, dressings and medications should be assembled according to the eye

department's preferences and kept available in the recovery room for prompt use The following are recommended as a minimum

INSTRUMENTS
- Flashlight (focusing)
- Ophthalmoscope
- Magnifying loupe
- Lid retractor
- Fine tissue forceps
- Pointed eye scissors
- Bandage scissors

MEDICATIONS
- Antibiotic solution and ointment
- Anesthetic solution and ointment
- Cycloplegic solution and ointment
- Miotic solution and ointment
- Physiological saline solution
- Sodium fluorescein solution

DRESSINGS
- Eye pads
- Cotton
- Adhesive or cellophane tape
- Aluminum eye shields
- Elastic roll bandage (2 inch)
- Toothpick swabs

Eye solutions and ointments, when ordered, are best instilled behind the lower lid and into the lower conjunctival fornix by drawing the skin below the lower lid downwards while the patient looks upwards A single drop of solution or a drop-sized portion of ointment is sufficient The instilling tip of the dropper or tube should never touch the edge of the lid and thereby become contaminated, but it must come close enough to the eye to avoid splattering (Figs 1 and 2)

Occlusive eye dressings of laminated cotton-gauze pads are secured with adhesive or cellophane tape by anchoring at the forehead and cheek Pressure dressings are applied similarly, but need more padding and tightly

Fig 1

Fig 2

Fig 1 Proper instillation of a solution into eye
Fig 2 Proper instillation of ointment into eye

Fig 3 Occlusive eye dressing

Fig 4 Pressure eye dressing

Fig 5 Protective shield over eye dressing

overlapping tape strips or elastic roller bandage (Figs 3 and 4) To protect the eye which has been operated upon further, a stiff mask or shield is placed and secured atop the eye dressings (Fig 5)

SPECIAL ASPECTS OF EYE ANESTHESIA

As mentioned earlier, most eye surgery is performed with the patient under regional (retrobulbar) anesthesia General anesthesia is usually reserved for children, psychotics and unusually apprehensive, uncooperative or tremulous persons With either type of anesthesia, however, a topical anesthetic, facial akinesia, or curare-like agents may be used to enhance the anesthetic effects

For *topical anesthesia* a surface anesthetic, such as tetracaine, is used to prevent pain due to stimuli from the conjunctiva and cornea during and immediately after surgery However, since the effects last only about fifteen minutes, the instillation must be repeated when a prolonged result is required

Facial akinesia is produced by injecting an anesthetic agent (e g , procaine) around the region of the facial nerve trunk or its branches to block motor innervation to the orbicularis oculi muscle (Fig 6) This will prevent forceful closure of the lids for about three hours

Curare-like agents are used by some eye surgeons to weaken or paralyze the extraocular muscles during surgery and thereby reduce the chance for complications from undesirable eye movements Their use for this purpose is still rather experimental

Fig 6 Technique employed in inducing facial akinesia

Regional Anesthesia

Regional anesthesia is preferred by almost all eye surgeons because it avoids the problem of postanesthetic complications (respiratory, gastrointestinal, and others) and the need for intratracheal manipulations, bulky apparatus around the face, and body restraints The patients are given a barbiturate and a narcotic to produce mild sedation, and tend to drift into a light sleep, free of pain, from which they are easily aroused to follow commands and perhaps report subjective sensations They usually can return to their hospital rooms and regular floor nursing care immediately after leaving the operating room

General Anesthesia

General anesthesia carries with it three special dangers to the eye concerning which operating room and recovery room personnel should be informed chemical injury to the cornea and conjunctiva, pressure damage to ocular circulation and self-injury

Chemical injury to the cornea and conjunctiva takes place when volatile anesthetic agents (e g , ether, chloroform, Vinethene) are accidently spilled into the eye, causing superficial and coagulative damage to the epithelial tissues and considerable pain, discharge and blurred vision Fortunately, this damage is reversible, when proper treatment is instituted, because the epithelial tissues regenerate in several days When such an accident occurs a surface anesthetic (e g , 0 5 per cent tetracaine) is instilled to stop any pain, the eye is irrigated with a liberal quantity of saline solution and, lastly,

a suitable antibiotic (e g , sulfacetimide) solution is instilled into the eye to prevent secondary infection

Pressure damage to ocular circulation can readily occur during general anesthesia in both nonocular and ocular patients Sustained and firm pressure on the eye by such objects as a hand, bony arm prominence, pillow, rubber mask edge, or tubing, increases the intraocular pressure and may interrupt the retinal blood flow and result in permanent visual loss It is the obvious responsibility of the anesthesiologist in the operating room and the nurse in the recovery room to guard the deep-sleeping patient against this serious danger, for treatment has been fruitless to date

Self-injury to the vulnerable postoperative eye can be inflicted by the patient as he emerges from general anesthesia because he tends to claw and rub the eye and move his head excessively Therefore, the patient must be restrained and protected diligently until fully awake

PREVENTION AND RECOGNITION OF OCULAR COMPLICATIONS

As stated at the beginning of this chapter, recovery room personnel can render service by striving to prevent and recognize ocular complications in eye patients under their care

Means of Prevention

The means of prevention have also been suggested earlier and can now be summarized under three headings

1 REASSURANCE Eye patients need cheerful and frequent verbal encouragement Especially those having both eyes covered feel strange, fearful and alone They are startled and alarmed by treatments or manipulations which are given without warning Therefore, it is best to first speak to the patient and to explain procedures to him

2 SHIELDING AND PROTECTION OF THE EYE This is accomplished by hand and arm restraints, or elbow splints, until the patient has recovered from general anesthesia, and by keeping a rigid shield over the eye dressings to prevent accidental injury

3 MINIMIZATION OF MOVEMENTS This admonition applies particularly to patients who have had intraocular surgery It is not necessary to insist on absolute immobilization of the body, for this is an impossible requirement Narcotics, anodynes, barbiturates or antiemetic drugs may be needed to help in minimizing motion

Means of Recognition

The most important postoperative complications in an eye are hemorrhage and rupture or dehiscence of the surgical wound The hemorrhage

may be obvious, through saturation of the dressings, or concealed within the eyeball Likewise, the wound rupture may be macroscopic or microscopic in degree When these complications are obscure, only the trained observer can recognize them, but, whether obvious or obscure, the following symptoms and signs should alert one to their possible presence

1 *Presence of blood stain* on the bandages which seems to be increasing in size

2 *Severe pain* which is either persisting or increasing within or around the eye that has been operated upon

When either or both of these conditions exist the eye surgeon or his assistant should be notified immediately

SPECIFIC PROBLEMS AND ROUTINES IN EYE CARE

Eye patients requiring intensive therapy in a recovery room can be differentiated, for purposes of management, into three groups, according to their special requirements and problems the extraocular surgical group, the intraocular surgical group and the group with eye injuries In presenting these groups, surgical terms will be mentioned which are unfamiliar to those in other fields of medicine A glossary of the more common ones has therefore been placed at the end of this chapter

Care of Extraocular Surgical Patients

This group of patients consists of those who have had operations involving the orbit and its contents, extraocular muscles, lids, lacrimal apparatus, conjunctiva, superficial cornea, and the globe or eyeball itself, when enucleated or eviscerated The following is a partial list of procedures to which members of this group may have been subjected.

ORBITAL PROCEDURES
- Exenteration
- Exploration
- Fracture reduction
- Decompression

LID PROCEDURES
- Canthotomy
- Blepharorrhaphy
- Tarsorrhaphy
- Ptosis correction
- Ectropion correction
- Entropion correction
- Laceration repair

CONJUNCTIVAL PROCEDURES
- Conjunctival plastic operation
- Repair of chemical injuries

LACRIMAL PROCEDURES
- Dacryorhinocystotomy
- Dacryocystectomy
- Nasolacrimal probing
- Laceration repair

SUPERFICIAL CORNEAL PROCEDURES
- Superficial keratectomy
- Peritomy
- Tattooing

GLOBE PROCEDURES
- Enucleation
- Evisceration
- Cyclodiathermy

EXTRAOCULAR MUSCLE PROCEDURES
- Recession
- Resection
- Advancement

In performing these procedures, it is not necessary to enter the eyeball, hence the designation "extraocular" Either regional or general anesthesia is used The eye is usually dressed and bandaged with a firm pressure dressing A protective shield is sometimes advisable for a few days

In the recovery room the dressing may have to be reinforced or tightened If the patient is asleep, precautions are necessary to prevent self-injury from wild hand and arm movements by using restraints But, except for this restriction, strict immobility is not essential The head and body can be moved rather freely It is permissible to roll the patient (towards the side which has not been operated upon) to aspirate secretions from the throat and promote gravitational drainage from the upper respiratory tract The principal postoperative complication occurring in this group is hemorrhage from the operative site, and therefore any sign of blood saturating the dressings should be reported and investigated

Routine orders for this group when leaving the recovery room are as follows

1 Keep the eye dressing firm against the eye, using additional tape if necessary
2 Give aspirin (10 grains) and codeine (1/2 grain) orally every four hours for relief of pain, as necessary
3 Patient may be propped up in bed as he desires, but may turn only to the side which has not been operated upon
4 Patient may have bathroom privileges, he should be assisted, at first, by a nurse or aide
5 Normal diet and fluids

Care of Intraocular Surgical Patients

This group of patients consists of those who have had operations upon the globe, deep corneal layers, sclera, iris, ciliary body, lens, vitreous and retina On page 186 is a partial list of procedures to which members of this group may be subjected

In performing these procedures it is necessary to enter the eyeball and/or manipulate tissues under the fibrous tunic of the eye (i e , sclera and cornea) The integrity of the wound during the early postoperative period is obviously important For these procedures, also, either regional or general anesthesia is used The eye is dressed with occlusive dressings and a protective shield or mask is applied Often binocular patches are applied to insure maximum inactivity of the eyes, and, when this is done, the eye which has been operated upon will be identified or "tagged" by an extra piece of adhesive tape placed on the mask or brow

GLOBE PROCEDURES
- Perforating injury repair
- Extraction of intraocular foreign body
- Traumatic rupture repair

CORNEAL PROCEDURES
- Keratoplasty
- Trephination
- Paracentesis

SCLERAL PROCEDURES
- Sclerectomy
- Scleral resection
- Scleral buckling

IRIS AND CILIARY BODY PROCEDURES
- Iridectomy
- Iridotomy
- Iris transfixion
- Iridodialysis
- Iridencleisis
- Cyclodialysis
- Goniotomy
- Goniopuncture

LENS PROCEDURES
- Intracapsular lens extraction
- Extracapsular lens extraction
- Linear extraction
- Discission
- Capsulectomy

VITREOUS PROCEDURES
- Transplantation
- Intravitreal injection (air or saline solution)

RETINAL PROCEDURES
- Electrodiathermy
- Electrolysis

In the recovery room the "keynote" in the care of this group of patients should be "LIMIT ALL HEAD MOVEMENTS AS MUCH AS POSSIBLE" If the patient is asleep, strict precautions are necessary to prevent self-injury and violent head movements When he is awake, he should lie supine with his head on a small pillow Slow, limited head movements are permissible, but *the head is never lifted off the pillow* Usually a few kind, reassuring words relax the patient as much as does an opiate Since the eye which has been operated upon is covered and shielded, complications will be difficult to detect Any persisting or increasing pain in or near the eye is an important symptom and should be reported to the surgeon It is desirable to have the surgeon or his assistant supervise the transfer of the patient to his hospital room

Routine orders for this group when leaving the recovery room are as follows

1 Keep patient supine A single pillow is permitted
2 Apply bed rail
3 Limit visitors to the immediate family Perhaps name them
4 Prohibit incoming and outgoing telephone calls
5 Order a soft diet fed to the patient while he remains flat
6 Prohibit bathroom privileges and bed linen changes
7 Keep room darkened

8 Give aspirin (10 grains) and codeine (1/2 grain) orally every four hours for pain as necessary
9 Report any persisting or increasing pain in the eye to the surgeon or his assistant *at any hour*

Care of Patients with Eye Injuries

All patients having eye injuries ultimately require specialized care by an ophthalmologist The initial attention, however, is the responsibility of the first professional person who attends the patient, and this care will enhance or ruin the final prospects of the eye

Chemical injuries, especially those due to an alkali, demand the most immediate treatment with copious irrigations of water or physiological saline solution This treatment is made easier by first instilling a topical anesthetic (e g , 0 5 per cent tetracaine) If a particulate chemical is present, a lid retractor is needed to lift the lid while the chemical is being flushed out of the fornices

Patients with concussion and perforating injuries of the eye require ophthalmological care from the beginning, and such patients are handled in the same manner as the intraocular surgical group, with absolute bed rest and shielding to the eye No eye medications or manipulations should be instituted until an accurate appraisal of the eye damage is made

Finally, anyone with a head or face injury should be suspected of having eye damage as well, because such eye injuries are often masked or overlooked

A BRIEF GLOSSARY OF OPHTHALMOLOGICAL SURGICAL TERMS

Advancement of eye muscle Surgical detachment of an extraocular muscle tendon followed by reattachment at an advanced point to correct strabismus

Blepharoplasty The plastic surgery of the eyelids

Canthotomy Surgical division of the outer canthus horizontally

Capsulectomy Excision of the capsule of the crystalline lens

Cyclodialysis The operation of forming a communication between the anterior chamber of the eye and the suprachoroidal space to overcome glaucoma

Cyclodiathermy Destruction of a portion of the ciliary body by electrodiathermy in cases of glaucoma

Dacryocystectomy Excision of the wall of the lacrimal sac

Dacryocystorhinostomy The operation of forming a communication between the lacrimal sac and the middle meatus of the nose through the lacrimal bone

Ectropion The eversion of the edge of the eyelid

Electrodiathermy The generation of heat in tissue by high frequency electric current sufficient to coagulate and destroy tissue Utilized in correction of glaucoma and retinal detachment

Electrolysis The passage of a direct (galvanic) electric current through tissue to destroy tissue cells

Entropion The inversion of the edge of the eyelid

Enucleation The removal of the eyeball, en toto

Evisceration The removal of the contents of the eye, the sclera being left intact
Exenteration The removal of the orbital contents en masse
Extracapsular lens extraction The removal of the cataractous crystalline lens after its capsule is opened
Goniopuncture Operation to create a perforated channel connecting the anterior chamber angle space and the subconjunctival space Performed to relieve congenital glaucoma
Goniotomy Operation to open the angle trabeculum and relieve congenital glaucoma
Intracapsular lens extraction Removal of the cataractous crystalline lens en toto within its capsule
Iridectomy Surgical excision of a part of the iris
Iridencleisis Deliberate strangulation of a slip of the iris in a corneal incision to correct glaucoma
Iridodialysis The separation or loosening of the iris from its attachment
Iridotomy An incision into the iris
Iris transfixion Piercing through of the iris to relieve pupillary obstruction to aqueous flow
Keratectomy Excision of a portion of the cornea
Keratoplasty Plastic surgery of cornea, viz, corneal grafting
Linear extraction Method of removal of congenital cataract
Nasolacrimal probing Maneuver to force patency to the nasolacrimal duct system
Orbital decompression Removal of a portion of the orbital wall to relieve intraorbital compression which is creating harmful exophthalmos (protrusion of the eye)
Paracentesis Surgical puncture of the eyeball—usually into the anterior chamber
Peritomy Surgical incision of the conjunctiva and subconjunctival tissue about the whole circumference of the cornea
Ptosis Drooping of the eyelid
Recession of eye muscle Surgical detachment of the muscle tendon followed by reattachment at a more proximal position
Resection of eye muscle Surgical detachment and excision of a portion of muscle tendon, followed by reattachment of the remaining tendon to the original site of insertion
Scleral buckling Surgical thinning and in-(or e-)vagination of a scleral sector to help correct retinal detachment
Scleral resection (or shortening) Surgical excision of a scleral sector to help correct retinal detachment
Sclerectomy Surgical excision of a portion of the sclera adjacent to the cornea to overcome glaucoma
Tattooing The permanent coloring of the cornea chiefly to conceal scars
Trephination The surgical boring of a circular opening in the corneoscleral region (limbus) to correct glaucoma

Chapter 6

SURGERY OF THE EAR, NOSE AND THROAT

FRANCIS L LEDERER, M D, and EMANUEL M SKOLNIK, M D

RESOURCEFULNESS becomes a matter of split-second timing and common sense response when the urgency of the moment requires Avoidance of surgical misadventures (accidents and complications) is accomplished by careful planning and readiness to meet every expected need Surgical logistics require skill and the detailed training of all personnel, both medical and perimedical

The otolaryngological procedures to be covered in this chapter are those most frequently performed They may be modified by personal preference and existing physical facilities, but are in the main designed for their basic principles of application

THE EAR

RADICAL MASTOIDECTOMY

General Care

Following radical mastoidectomy the patient should be kept in bed for the first twenty-four hours with his head down His surroundings should be quiet, and the light dim He may be allowed out of bed on the second postoperative day

He may be given a diet as tolerated

Analgesics such as Demerol and codeine are given as required for relief of pain Sedatives are given to allay restlessness Antibiotics should be administered only when complications develop or a febrile reaction is manifest

Complications

The possible complications include facial paralysis, hemorrhage, labyrinthitis, meningitis, lateral sinus thrombosis and otogenic brain abscess

Peripheral facial paralysis becoming evident during the operation is due to surgical trauma It is treated by immediate decompression of the nerve If the nerve has been severed, an end-to-end anastomosis is performed Facial paralysis becoming evident several hours following operation usually is due to edema of the nerve or to extreme pressure of the packing on an exposed portion of the nerve This is treated by removal of the packing and redressing of the wound, a minimal amount of pressure being applied

Hemorrhage, in most instances, is of venous origin This can be easily controlled with packing and is usually of little significance

Labyrinthitis may be serous or purulent The serous type is evidenced by vertigo, loss of equilibrium and impairment of hearing, nystagmus may be present Antihistaminics (Bonamine or Dramamine) and sedatives will usually give relief of symptoms Purulent labyrinthitis is evidenced by complete loss of hearing and severe vestibular symptoms The packing should be removed from the mastoid cavity and drainage promoted Intensive antibiotic therapy should be instituted The patient should be observed closely for evidences of intracranial complications

Meningitis is manifested by elevated temperature, headache and stiff neck Spinal tap is necessary to confirm or disprove the diagnosis The meningitis may be an external pachymeningitis or a diffuse meningitis Either type is treated by removing the packing from the mastoid cavity and giving more intensive parenteral antibiotic therapy than had been employed If indicated, the surgical cavity should be revised and the tegmen removed

Lateral sinus thrombosis is characterized by septic temperature chills, frequently associated with a sixth nerve palsy of the same side (with deep-seated pain) and papilledema X-ray films may show evidence of involvement of the bony covering of the sinus plate The reaction to the Queckenstedt test (increase of cerebrospinal fluid pressure on compression of the internal jugular veins) is negative Surgical opening of the sinus is indicated Following this the patient should have absolute bed rest in a dim and quiet room His blood pressure and pulse and respiration rates should be checked every fifteen minutes until they have become stable The state of shock is combated with cardiac tonics and intravenous fluids Oxygen therapy is given as needed Antibiotics are administered in high dosage, both intravenously and intramuscularly Anticoagulants (Dicumarol, heparin) may be useful, but transfusions of whole blood are best Diet is governed by toleration, plenty of fluids should be given orally, if possible Local treat-

ment consists in gentle and gradual removal of the packing during the first five days following the opening of the sinus The dressings are changed frequently to permit the wound to granulate For a long time the patient is watched clinically and frequent x-ray check is made

Otogenic brain abscess is generally the result of inadequate surgery or a process that has gone beyond the confines of mastoid cavity per se, and frequently is not diagnosed until several days following mastoid surgery When it occurs the mastoid cavity should be revised, the tegmen taken down, and the brain abscess drained by aspiration through the dura The general care following this is the same as that described for the lateral sinus thrombosis patient, except no anticoagulants are employed The dressings are changed frequently, at least once a day Complete drainage of the abscess should be assured, because this is the essential condition for healing, diverticula or secondary cavities will cause recurrence, and the abscess must close progressively from the inside to the periphery Recovery is characterized by the disappearance of headache, obnubilation and nystagmus Persistence of the symptoms is indicative of encephalitis or secondary abscess Papilledema may persist for a long time Sequelae may be represented by psychic troubles and epileptic seizures

Care for Epidermization of Mastoid Cavity

In dressing the wound, absolute sterile technique should be employed for about a month after operation The external dressings are changed as needed The packing and stitches are removed about a week after operation Antibiotic powder is insufflated into the cavity and a sterile cotton wick is placed in the meatus The second dressing is done on the tenth postoperative day A 2 per cent aqueous solution of gentian violet and antibiotic powder are applied

FENESTRATION

General Care

Following this operation the patient is kept in a lying position for the first twenty-four hours, and then the head of the bed is gradually elevated until the patient assumes a semi-sitting position by the third or fourth postoperative day If there is a minimum of dizziness he is allowed out of bed in a wheel chair The room should be extremely quiet and dimmed for the first twenty-four hours

The blood pressure and pulse and respiration rates are checked four times a day until they are normal and stabilized The temperature is checked three times daily

The diet is guided by the patient's tolerance As a rule the fenestration operation is associated with severe dizziness and vomiting If dehydration occurs, *fluids should be given intravenously in moderate amounts For a* period of two to three days the patient may have to be placed on a surgical liquid diet administered every three hours The symptoms of dizziness and vomiting will determine the dietary regimen

Bonamine (25 mg given three times a day) or Dramamine (50 mg three times a day) will aid greatly in the control of the severe vertigo and vomiting If the patient is unable to take medication orally the parenteral route may be used Antibiotics should be administered in adequate dosage for at least a week Analgesics may be given for the relief of pain (Demerol, codeine) and sedatives to allay restlessness

Complications

The possible complications include facial paralysis, hemorrhage, labyrinthitis and meningitis

Facial paralysis and hemorrhage are treated in the same manner as when they occur following radical mastoidectomy

Serous labyrinthitis always develops to some slight degree following fenestration The patient usually complains of vertigo of a rotatory type, *loss of equilibrium and lowering of the hearing threshold* Horizontal nystagmus is clearly visible, past pointing and drift can be elicited The Weber test (with the 256, 512 or 1024 tuning fork) shows lateralization to the ear which has not been operated upon, owing to cochlear depression However, bone conduction hearing can be evidenced in the ear subjected to operation Antihistaminics (Bonamine or Dramamine) and sedatives can be usefully administered The symptoms of serous labyrinthitis usually disappear three weeks after the operation, dizziness and nystagmus can be elicited only during sudden movements and when pressure is exerted on the fenestra by instrumentation

Purulent labyrinthitis is evidenced by complete loss of hearing in the ear which has been operated upon and increase in vestibular symptoms The packing should be removed and antibiotics should be administered in high dosage, observation should be maintained for evidence of intracranial extension

Meningitis is evidenced by elevated temperature (over 101° F in adults), associated with headache and stiff neck Spinal tap is performed to confirm or disprove the diagnosis In view of the antibiotic therapy instituted preoperatively and continued postoperatively, it may be necessary to increase the amount, combine the drug in use with a synergistic antibiotic, or replace the original drug used with other antibiotics

Care for Epidermization of Cavity

Unnecessary manipulation should be avoided Complete aseptic technique is a must The first dressing is done on the sixth postoperative day, employing completely sterile technique The packs over the flap are left in situ Antibiotic powder is insufflated into the wound The stitches are removed The second dressing is done on the tenth postoperative day, sterile technique being used All packs are removed Antibiotic powder is insufflated into the wound An antiseptic is applied to the incision A sterile cotton wick is placed in the meatus Dressings are done in a similar manner on the fourteenth and twenty-first days On the twenty-first day the cavity is painted with a 2 per cent aqueous solution of gentian violet If any evidence of infection is seen in the cavity, daily dressings with the application of antibiotics are indicated

OTOPLASTY

General Care

The patient should rest in bed, lying on his back to avoid pressure on his ears, for the first twelve hours following otoplasty He may be given analgesics if he has pain Antibiotics should be administered to prevent infection His diet will depend upon his toleration

Local Care

To avoid displacement of fragments the dressings must not be disturbed The stitches are removed on the sixth postoperative day Trauma to ears should be avoided for at least a month

Complications

The complications consist of hematoma and local infection

When a hematoma occurs the dressings are removed and the blood is aspirated according to sterile technique A pressure dressing is then applied

When signs of local infection occur, the dressing is removed The wound is cleaned thoroughly and packed with Aureomycin gauze The amount of antibiotics given parenterally is increased

THE THROAT

TONSILLECTOMY

General Care

Bed rest is enforced for the first twenty-four hours following operation An ice collar is applied continuously Ice chips are given by mouth six hours after operation The early diet consists of ice cream and gelatin

The diet is guided by the patient's tolerance As a rule the fenestration operation is associated with severe dizziness and vomiting If dehydration occurs, fluids should be given intravenously in moderate amounts For a period of two to three days the patient may have to be placed on a surgical liquid diet administered every three hours The symptoms of dizziness and vomiting will determine the dietary regimen

Bonamine (25 mg given three times a day) or Dramamine (50 mg three times a day) will aid greatly in the control of the severe vertigo and vomiting If the patient is unable to take medication orally the parenteral route may be used Antibiotics should be administered in adequate dosage for at least a week Analgesics may be given for the relief of pain (Demerol, codeine) and sedatives to allay restlessness

Complications

The possible complications include facial paralysis, hemorrhage, labyrinthitis and meningitis

Facial paralysis and hemorrhage are treated in the same manner as when they occur following radical mastoidectomy

Serous labyrinthitis always develops to some slight degree following fenestration The patient usually complains of vertigo of a rotatory type, loss of equilibrium and lowering of the hearing threshold Horizontal nystagmus is clearly visible, past pointing and drift can be elicited The Weber test (with the 256, 512 or 1024 tuning fork) shows lateralization to the ear which has not been operated upon, owing to cochlear depression However, bone conduction hearing can be evidenced in the ear subjected to operation Antihistaminics (Bonamine or Dramamine) and sedatives can be usefully administered The symptoms of serous labyrinthitis usually disappear three weeks after the operation, dizziness and nystagmus can be elicited only during sudden movements and when pressure is exerted on the fenestra by instrumentation

Purulent labyrinthitis is evidenced by complete loss of hearing in the ear which has been operated upon and increase in vestibular symptoms The packing should be removed and antibiotics should be administered in high dosage, observation should be maintained for evidence of intracranial extension

Meningitis is evidenced by elevated temperature (over 101° F in adults), associated with headache and stiff neck Spinal tap is performed to confirm or disprove the diagnosis In view of the antibiotic therapy instituted preoperatively and continued postoperatively, it may be necessary to increase the amount, combine the drug in use with a synergistic antibiotic, or replace the original drug used with other antibiotics

When a pulmonary foreign body—tooth, sponge, tonsil, blood, instrument—is present its position should be established radiologically It is removed by endoscopic means

Systemic complications—septicemia, pyemia, meningitis, embolism—are treated as indicated by the symptoms Antibiotic therapy is intensified and fluids are administered intravenously

Otalgia as a rule represents referred pain from the tonsillar fossae

INCISION OF PERITONSILLAR ABSCESS

General Care

Bed rest is maintained for at least twelve hours Warm gargles are indicated for their soothing and heat effects Antibiotics, selected according to sensitivity tests, are given parenterally

Complications

The complications include closure of the incision, hemorrhage and edema of the larynx

Closure of the incision is treated by reopening it with forceps

When hemorrhage is profuse it is controlled by packing the incision with a 1/4-inch gauze strip

In edema of the larynx the airway is evaluated by indirect laryngoscopy Tracheotomy is performed if indicated Whenever there is any doubt as to the airway, it is best to tracheotomize the patient Procrastination may result in serious consequences

HEMIGLOSSECTOMY

General Care

Bed rest is maintained for the first twenty-four hours following operation A cold, bland liquid diet is given Tart juices or spices are avoided for about two weeks The patient's mouth is washed with peroxide solution (half strength of a 3 per cent solution) after each meal Anodynes (Demerol, codeine) are given as required Broad spectrum antibiotics should be administered A suction machine should be present at the patient's bedside for use if needed

Complications

The complications include hemorrhage and laryngeal edema

When hemorrhage occurs the oral cavity is inspected by direct illumination The bleeders are ligated

When laryngeal edema is manifest the airway is inspected by indirect

Rectal suppositories (barbiturate) are given for the relief of pain and restlessness The temperature and respiration rate are checked every hour until they are normal Antibiotics should be administered if the patient had frequent exacerbations or organic disease (rheumatic fever, rheumatic heart disease) before the operation The administration of vitamins K and C has not been shown to be of any definitive value

Complications

The complications include hemorrhage, shock, local infection, respiratory obstruction, foreign body in the lungs or bronchi, systemic complications and otalgia

Hemorrhage is evidenced by dehydration, restlessness, fever, tachycardia and tachypnea Immediate hemorrhage is that occurring six to twelve hours after operation The pharynx and check tonsillar fossae should be checked carefully for evidence of clotted blood Large quantities of bright red blood may be vomited Any clots found should be removed under direct vision of the pharyngeal cavity Pressure is applied over the bleeding tissues by using a gauze sponge If bleeding is profuse the bleeders are tied off and the bed of the tonsillar fossa is sutured The use of cauterizing chemicals is avoided General anesthesia should not be used for the suturing if the bleeding occurs on the day of the original operation, since its use at this time may cause a systemic reaction A rectal anesthetic (a barbiturate) to sedate the patient is indicated If all other methods of control of bleeding fail, the external carotid artery should be ligated Transfusion with plasma or whole blood should be given according to the general condition of patient

Delayed hemorrhage, occurring on the fifth to seventh day postoperatively, is usually due to infection and sloughing Treatment consists in suturing the bleeding area

Shock is evidenced by embarrassed respiration, cold extremities and difficulty in arousing the patient The patient is placed in the Trendelenburg position (foot of bed raised) Oxygen under pressure is administered The heart is stimulated with Coramine or strychnine Whole blood or 5 to 10 per cent dextrose solution is given intravenously

Local infection—phlegmonous inflammation, abscess, or lymphadenopathy—is treated by institution of adequate drainage of the purulent collection and the administration of appropriate antibiotics, as determined by culture and sensitivity tests, parenterally in large dosages

Respiratory obstruction may be due to edema of the uvula, palate or larynx When it occurs the airway should be checked with the aid of indirect laryngoscopy Tracheotomy should be performed, if indicated

NASOANTRAL WINDOW

General Care

The patient is placed in bed with his head turned to the side not operated upon to favor drainage Anodynes may be given if necessary The diet is governed by tolerance Antibiotics are administered only when fever is present or complications occur

Local Care

The sinus operated upon is irrigated on the first postoperative day and then every day thereafter until the return is clear

Complications

These include hemorrhage and persistent suppuration

Hemorrhage occurs rarely following this operation It can be controlled by packing the cavity

Persistent suppuration may indicate that more radical treatment is required.

CALDWELL-LUC OPERATION

General Care

The patient should be kept in bed for the first twenty-four hours following operation, with his head raised and turned to the side not operated upon to favor drainage He may be allowed out of bed on the following day Anodynes are given for relief of pain as indicated Antibiotics are administered if fever or complications are present The diet is governed by tolerance The patient should rinse his mouth after each meal with hydrogen peroxide (half strength of a 3 per cent solution) To avoid subcutaneous emphysema he should not blow his nose

Local Care

The packing is removed progressively, starting on second postoperative day The stitches are removed from the vestibulum of the mouth on the sixth postoperative day Thereafter the sinus which has been operated upon should be irrigated through the inferior meatus every other day until a clear return is obtained

Complications

The complications include hemorrhage, hematoma, severe pain, fever and oroantral fistula

Hemorrhage is controlled by packing the cavity

laryngoscopy Moderate edema is treated by administering oxygen and intensifying the antibiotic therapy A tracheotomy set should be in readiness by the patient's bedside If the edema becomes severe a tracheotomy should be performed

THE NOSE AND ACCESSORY SINUSES

SUBMUCOUS RESECTION OF NASAL SEPTUM

General Care

Bed rest, with the patient's head somewhat elevated to favor outward drainage of blood, is maintained for twelve hours following the operation To avoid bleeding, the patient should not attempt to blow his nose Anodynes may be given for relief of pain and sedatives to allay restlessness The diet is governed by toleration Hot food and excessive liquids should be avoided

Local Care and Patient Instructions

The packing is removed from the nose after twenty-four hours A wick of sterile cotton is placed in each nostril The patient is instructed not to blow his nose, to avoid intranasal trauma and the use of intranasal ointment, and to engage in no vigorous activity for several days

Complications

These are hemorrhage, swelling of the nose, headache, hematoma and fever

If only slight oozing of blood is present, it is not necessary to remove the packing If the bleeding is severe, the packing is removed and the bleeding points are checked under direct illumination The nose is repacked with petrolatum gauze

Mild swelling of nose is a common reaction and requires no treatment When the swelling is pronounced the packing should be removed and antibiotics should be given

Headache may be due to tight packing and/or sinusitis When it occurs the packing should be partially removed, the antibiotic therapy intensified, anodynes given in higher dosage if indicated, and the temperature closely observed

Hematoma of the roof of the palate will disappear spontaneously

If the patient has fever he should be kept in the hospital The antibiotic therapy should be intensified and observation maintained for signs of intracranial complications

NASOANTRAL WINDOW

General Care

The patient is placed in bed with his head turned to the side not operated upon to favor drainage Anodynes may be given if necessary The diet is governed by tolerance Antibiotics are administered only when fever is present or complications occur

Local Care

The sinus operated upon is irrigated on the first postoperative day and then every day thereafter until the return is clear

Complications

These include hemorrhage and persistent suppuration

Hemorrhage occurs rarely following this operation It can be controlled by packing the cavity

Persistent suppuration may indicate that more radical treatment is required

CALDWELL-LUC OPERATION

General Care

The patient should be kept in bed for the first twenty-four hours following operation, with his head raised and turned to the side not operated upon to favor drainage He may be allowed out of bed on the following day Anodynes are given for relief of pain as indicated Antibiotics are administered if fever or complications are present The diet is governed by tolerance The patient should rinse his mouth after each meal with hydrogen peroxide (half strength of a 3 per cent solution) To avoid subcutaneous emphysema he should not blow his nose

Local Care

The packing is removed progressively, starting on second postoperative day The stitches are removed from the vestibulum of the mouth on the sixth postoperative day Thereafter the sinus which has been operated upon should be irrigated through the inferior meatus every other day until a clear return is obtained

Complications

The complications include hemorrhage, hematoma, severe pain, fever and oroantral fistula

Hemorrhage is controlled by packing the cavity

A hematoma is generally absorbed

Severe pain is relieved by giving sedatives, analgesics and, eventually, narcotics

Fever is usually indicative of osteitis or ascending infection in the nasal cavity When it occurs, all packs should be removed and intensive antibiotic therapy instituted

Treatment of a small oroantral fistula consists in cauterizing the edges If the fistula is large, its edges are freshened and sutured

RADICAL FRONTAL SINUS OPERATION

General Care

The patient remains in bed for the first twenty-four hours with his head slightly raised After this he may be ambulatory, if his condition permits Analgesics (Demerol) are administered if necessary Antibiotics are given when a complication or fever is present The diet is governed by tolerance To avoid subcutaneous emphysema the patient is instructed not to blow his nose

Local Care

A pressure bandage is placed over the eye on the side operated upon for the first twenty-four hours to decrease the reaction The drain is left in situ for three to four days to prevent retention The stitches are removed on the sixth postoperative day

Complications

The complications include subcutaneous emphysema, retention accident, diplopia, osteomyelitis and fistulization

Subcutaneous emphysema usually occurs if the patient blows his nose after the operation It is treated by applying a compressive dressing for a few days, and, eventually, removing a few sutures

Retention accident is evidenced by frontal pain, palpebrofrontal edema and fever When it occurs, all packs should be removed and a drain inserted into the cavity

Diplopia is due to injury to the tendon superior oblique muscle

Osteomyelitis may occur when operation is performed when the sinusitis is in the acute stage It is usually characterized by headache, edema and fever The involved bone should be removed and intensive antibiotic therapy instituted

When fistulization occurs the packs are removed and the fistula is closed

MAXILLARY RESECTION

General Care

Bed rest is maintained for the first twenty-four hours with the head of the bed raised to favor outward drainage of blood The patient may be ambulatory thereafter if his condition permits The blood pressure and pulse and respiration rates are checked every fifteen minutes until they become stable Oxygen therapy is given if necessary An ice bag is placed over the operative site and ice chips are given the patient by mouth as indicated Analgesics (Demerol) and sedatives (barbiturates) are administered as needed Antibiotics are administered because of the contact of the operative site with infected cavities (mouth and nose) If necessary the patient may be fed through a Levin tube for the first few postoperative days A soft diet is given by mouth if this is tolerated

Local Care

The packing is changed on the fourth postoperative day The stitches are removed on the sixth postoperative day A foam-rubber temporary prosthesis is placed in the cavity, the prosthesis being cut according to shape and size of the cavity It is explained to the patient that he can eat and talk much better with it in place The patient is instructed to remove and clean it at least twice a day A final plastic prosthesis is placed in the cavity when healing is complete

Complications

Hemorrhage, hematoma, local infection, pulmonary involvement and sloughing down of the flap comprise the complications

Some oozing of blood is the rule If bleeding is severe, the packing is removed, the bleeders are tied off or diathermocoagulated, and the cavity is repacked

A hematoma is generally reabsorbed

When local infection occurs the packing is removed and the cavity is cleansed with a 3 per cent solution of peroxide and repacked with Aureomycin gauze Antibiotic therapy is intensified and governed by culture and sensitivity tests

When pulmonary complications occur, the condition is evaluated clinically and radiologically and treatment instituted as indicated by the findings Antibiotic therapy is intensified

If the flap sloughs down the wound is cleansed thoroughly and the dressings are changed frequently The wound is allowed to granulate Secondary closure may be made after freshening the edges, if necessary

A hematoma is generally absorbed.

Severe pain is relieved by giving sedatives, analgesics and, eventually, narcotics

Fever is usually indicative of osteitis or ascending infection in the nasal cavity When it occurs, all packs should be removed and intensive antibiotic therapy instituted

Treatment of a small oroantral fistula consists in cauterizing the edges If the fistula is large, its edges are freshened and sutured

RADICAL FRONTAL SINUS OPERATION

General Care

The patient remains in bed for the first twenty-four hours with his head slightly raised After this he may be ambulatory, if his condition permits Analgesics (Demerol) are administered if necessary Antibiotics are given when a complication or fever is present The diet is governed by tolerance To avoid subcutaneous emphysema the patient is instructed not to blow his nose

Local Care

A pressure bandage is placed over the eye on the side operated upon for the first twenty-four hours to decrease the reaction The drain is left in situ for three to four days to prevent retention The stitches are removed on the sixth postoperative day

Complications

The complications include subcutaneous emphysema, retention accident, diplopia, osteomyelitis and fistulization

Subcutaneous emphysema usually occurs if the patient blows his nose after the operation It is treated by applying a compressive dressing for a few days, and, eventually, removing a few sutures

Retention accident is evidenced by frontal pain, palpebrofrontal edema and fever When it occurs, all packs should be removed and a drain inserted into the cavity

Diplopia is due to injury to the tendon superior oblique muscle

Osteomyelitis may occur when operation is performed when the sinusitis is in the acute stage It is usually characterized by headache, edema and fever The involved bone should be removed and intensive antibiotic therapy instituted

When fistulization occurs the packs are removed and the fistula is closed

Local Care

The dressing and splint are removed a week after operation The stitches are removed ten to fourteen days postoperatively Even minimal trauma should be avoided for at least a month

NASAL FRACTURE

General Care

Bed rest is maintained for the first twelve hours with the patient's head somewhat elevated to favor outward drainage of blood and secretions To prevent displacement of fragments the patient must avoid blowing his nose Antibiotic therapy is generally in order as the nasal cavity is contaminated Anodynes may be given for relief of pain and sedatives to allay restlessness The diet is governed by toleration, only small amounts of food are to be given

Local Care

Ice packs are placed over the nose to keep the swelling at a minimum

The packing or the nose are not disturbed lest the fragments be displaced The dressing and packing are removed at the end of the first postoperative week Even minimal trauma should be avoided for about a month at least

Complications

The complications are hemorrhage and infection

Hemorrhage is controlled by replacing the packing

When infection occurs the temperature should be checked frequently The antibiotic therapy should be intensified and the packing replaced with Aureomycin gauze

RHINOPLASTY

General Care

The patient is kept in bed for the first twelve hours following operation with his head somewhat elevated to favor outward drainage of blood He should not attempt to blow his nose Antibiotics must be administered to prevent infection from the contaminated nasal cavity and to avoid complications Anodynes (Demerol) may be given for relief of pain A diet is given as tolerated An ice pack is placed over the eyes to minimize the reaction

Complications

Swelling and hemorrhage are the complications

Swelling of the nose and surrounding regions is common If it is severe, wet cold packs should be applied

Hemorrhage usually occurs if the packing is not properly placed When it occurs, the nasal cavity should be repacked A hematoma, if present, should be aspirated with sterile technique

produces more than mere annoying discomfort, it is of truly physiological significance These far-reaching effects of thoracic pain are of tremendous importance

First, pain of even mild degree results in some limitation of thoracic expansion, but it assumes great importance when marked splinting of the chest wall occurs Most patients with an injured hemithorax automatically restrict motion on the affected side, continuing, however, to make relatively full use of the uninvolved rib cage Aggravation of pain, or failure to dissociate the motion in the two hemithoraces, produces shallow, jerky respirations which often are grunting in character, because now both sides are being affected Such a situation is obviously grave because ventilation is poor, cough is ineffective or even impossible, and secretions are retained in the bronchial tree This clinical picture often is the result of a vicious cycle initiated by pain which produces spasm of the chest wall musculature which can and does become of itself painful, and therefore pain leads to painful spasm, completing the vicious cycle

Secondly, even more subtle than these mechanical effects, pain can apparently produce pulmonary changes reflexly which tend to increase bronchial secretions and decrease the patient's ability to expel them, perhaps by producing some degree of bronchospasm and bronchorrhea This condition is called a "traumatic wet lung" and is a well-recognized clinical situation which often follows chest wall trauma

Control of pain, then, is of paramount importance and it is to be accomplished by judicious use of general measures, narcotics, and/or intercostal nerve block

General Measures A change of position in bed, a change in the elevation of the head rest, readjustment of pillows, readjustment of a lumpy or constrictive dressing, and proper attention to the possibility of tape or friction burns are always to be considered by the thoughtful attendant and their importance should not be minimized Drainage tubes often contribute to chest pain, but are a necessary evil in most instances Tubes that are too large constitute an aggravating source of pain when placed intercostally The tubes should be supported at the bedside by slings of some sort (pins or tape) so that they do not pull at the chest wall, and, for obvious reasons, care should be exercised that the patient does not lie on them

Narcotics Most adult patients can be carried on moderate doses of such drugs as morphine or Demerol, given every three or four hours Dosage should be gauged by the patient's size, age and tolerance to pain, rather than by any preconceived schedule Each dose should provide acceptable relief of pain, but should not unduly depress other functions, such as respiration, cough, or the patient's ability to cooperate It is better to use

Chapter 7

SURGERY OF THE CHEST

HIRAM T LANGSTON, M D

WHEN CONFRONTED BY THE PROSPECT of caring for a postoperative chest patient the uninitiated person is generally awed and is overtaken to some extent by fear of the unknown This mysterious aspect of the problem should be dispelled because it militates against a clear analysis of any abnormal situation and foils the application of logic to any corrective steps that may be required Even though there remains much to be learned about the intimate mechanisms of cardiorespiratory physiology, most of the clinical difficulties in the immediate postoperative period can be understood in the light of simple and basic principles

GENERAL CONSIDERATIONS COMMON TO ALL THORACIC SURGICAL PROCEDURES

Regardless of the type of operative intervention that was carried out, certain features are common to the postoperative period These will be considered separately insofar as possible

Pain

The discomfort produced by the incision through the soft tissues is of no particular significance, being, as a rule, no different from that caused by wounds of similar magnitude anywhere else The most important factor is the pain produced by the incision through the costal chest wall, regardless of whether it includes resection of rib, is entirely intercostal, or involves multiple-rib resection as in a thoracoplasty

It furthermore seems practical to classify such pain more or less arbitrarily as being of either psychological or physiological significance Psychologically significant pain is of primary concern to the patient because it is objectionable and disturbing—"just plain hurts" When the pain, however,

Care of the Tracheobronchial Tree

Attention to the respiratory system is generally accepted as a routine matter after any surgical procedure, but it is particularly important following operations that interfere directly with the function of the respiratory organs Particularly is this true following pulmonary operations for disorders in which more or less abundant tracheobronchial secretions occur Not only can these secretions become displaced throughout various por-

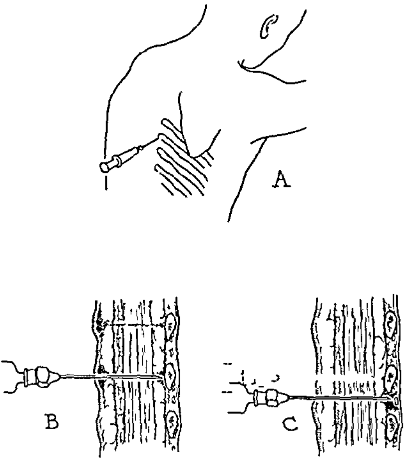

Fig 1 Technique of intercostal nerve block

tions of the pulmonary bed, but blood from the operative site may gravitate into the remaining portions of the system Thus, it is clearly understood that such situations must be corrected in the postoperative period if it has been impossible to prevent them during the surgical act In any event, the maintenance of anesthesia, the presence of endotracheal or endobronchial tubes and the manipulations required result in some increase in tracheobronchial secretion The methods employed in the toilet of the tracheobronchial tree include inducing the patient to cough, intratracheal catheter suction, bronchoscopy, use of miscellaneous adjuncts and tracheostomy

the small dose somewhat more often than to resort to a large dose with wider spacing in time This is particularly true if the patient is allowed to develop pronounced splinting of the chest wall between doses, because the vicious cycle mechanism (referred to above) of pain followed by painful spasm is more difficult to break up than it is to prevent Also, in patients who are unwilling to cough satisfactorily on demand, such an exercise will often be profitably engaged in after the narcotic has become effective Such timing can minimize the undesirable side effects of narcotic administration

INTERCOSTAL NERVE BLOCK Since thoracotomy incisions through the costal chest wall can and do easily implicate the intercostal nerves, blocking of these pathways emerges as a very logical procedure in the control of postoperative pain Furthermore, in the event of severe pain or particularly if there is difficulty in the expectoration of secretions and the presence of a "wet lung" is suspected, interruption of reflex pathways is mandatory In fact, it is often the dramatic improvement in the status of the pulmonary bed following intercostal or paravertebral anesthetic block that argues strongly for a reflex basis for the development of the "wet lung " The simplest procedure is the intercostal block and this technique is the one recommended

Procaine in 1 per cent solution is the agent of choice, utilizing 4 to 6 cc to each nerve The block should be carried to the nerve involved by the incision and extended to at least one or preferably two nerves above and below this in order to assure adequate control of overlapping innervation Attempts to block the intercostal nerve at a point medial to the angle of the rib are not recommended because of the danger that the solution may enter a prolongation of the dural sheath which occasionally extends outward to this point, and result in an intraspinal injection of the anesthetic agent Also, since the nerve runs obliquely across the intercostal space medial to the angle of the rib (and is not, therefore, located in juxtaposition to the rib), no satisfactory landmark is present to insure accuracy in the procedure Attempts to block the nerve anteriorly are generally unsatisfactory because the principal trunk of the nerve is being broken up by the giving off of its various branches The direct infiltration of a fractured rib at the site of fracture may, of course, be justified occasionally

Long-acting agents seem to offer no consistently superior results over procaine, and some of them may be distinctly dangerous Procaine blocks may be repeated as required, and, whereas the first attempt may bring relief that lasts for the expected period of pharmacological action of the drug, the second or third injection may result in prolonged periods of relief by interrupting muscular spasm

produced by too prolonged suction Oxygen for administration should be available between periods of active suctioning

The tracheal catheter can usually be guided into either bronchus electively by turning the head away from the side which it is desired to

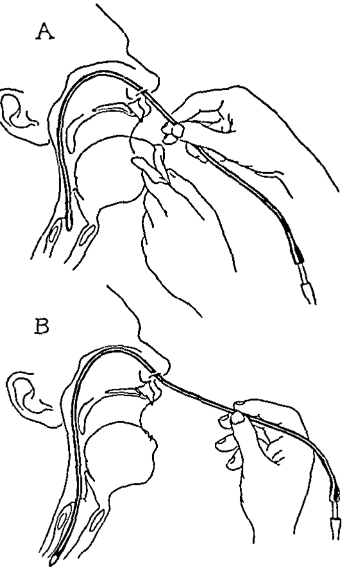

Fig 2 Technique of insertion of urethral catheter into the trachea

catheterize, i e , the head being turned to the left will permit catheterization of the right bronchus This is especially true if the catheter is passed through the nose instead of the mouth Obviously, the maneuver must be initiated with the tip of the catheter above the tracheal bifurcation

BRONCHOSCOPY Should the previously described methods fail, or, if the patient has developed a recognized atelectasis, cleansing of the tracheo-

Inducing the Patient to Cough During the first few hours after operation, spontaneous cough as well as probably the intrinsic bronchomotor mechanisms, which include ciliary action of the lining epithelium, is obtunded Pain, furthermore, makes the idea of coughing distinctly unattractive to the patient, so that the persons in attendance must insist on such performance It is not enough merely to order the patient to cough, but the order should be firmly, though sympathetically, insisted upon until three of four good deep coughs have either indicated a dry tracheobronchial tree or the secretions present have been delivered

Manual support of the operated upon or injured side by the attendant or by the patient's own hand, exerting gentle pressure timed to coincide with the expulsive effort of the cough, will often be helpful There is no method of cleansing the tracheobronchial tree that approaches cough in efficiency, and insistence on its proper execution is mandatory regardless of the estimated amount of secretions present

One other benefit derived from coughing is, of course, its effectiveness in promoting lung re-expansion when this organ or a portion of it remains to be expanded in the thoracotomized side

Intratracheal Catheter Suction Occasionally, a patient will resist the most persuasive and well-integrated efforts at effective coughing and some more certain method of stimulating cough is required To excite coughing, a urethral catheter, size 14 or 16 F, is inserted through the nose and passed into the oropharynx (Fig 2) When the tip of the catheter is estimated to be just above the level of the glottis, it is rapidly advanced during the inspiratory phase of respiration with the object of having it enter the trachea If difficulty is encountered in effecting this maneuver, changing the degree of flexion or extension in the neck or utilizing varying amounts of traction on the tongue may permit its accomplishment The entire maneuver is carried out as a blind procedure without preliminary preparation of the patient

Once the catheter enters the trachea, coughing can hardly be restrained Even though this alone may accomplish the desired results, intermittent suction applied by attaching a moderately strong suction apparatus to the catheter has the advantage of mechanically removing the liberated secretions The catheter should be introduced into the trachea disconnected from the suction apparatus or, if connected, the suction should be turned off, because active suction at the catheter tip renders it very difficult to pass the catheter through the glottis

The suction should be applied to the catheter for short periods of a few seconds only, because severe drops in oxygen saturation levels can be

be carried out, but this procedure, or its counterpart, the placement of an indwelling endotracheal tube, is to be performed only at the decision of a highly experienced person, because the circumstances demanding it indicate a very grave situation indeed One admonition seems warranted Once the endotracheal tube is placed or the tracheotomy is performed, virtually the entire responsibility for clearing the airway falls on the attendants, because the expulsive phases of cough on the part of the patient are decidedly reduced in efficiency

Oxygen Therapy

Administration of oxygen is standard practice, particularly in the immediate postoperative period, and is usually continued until the patient has regained consciousness and full reliance can be placed on the physiological mechanisms that control respiration Therefore, oxygen is indicated merely to insure that adequate oxygenation is maintained and should not be continued after the patient can accomplish this by breathing room air, because it reduces respiratory effort, thereby favoring decreased ventilation, and retards the mobilization of tracheobronchial secretions

It is important to emphasize the point that oxygen will relieve symptoms of respiratory distress, and is, therefore, a very useful drug, but, as in the case of narcotics, care should be exercised that it not be used merely to abate symptoms without correcting the underlying derangement that produced them

The weaning of the patient away from oxygen may be started whenever it is estimated that such a move is feasible on clinical grounds It should be initiated by reducing the flow from 5 or 6 liters per minute (which is the usual volume initially given) to 2 or 3 liters per minute The pulse rate is carefully checked before such reduction and then rechecked after a period of ten or fifteen minutes on the reduced flow If there is no appreciable elevation in the pulse rate, it can be assumed that sufficient oxygen is being given After another forty-five minutes or one hour have elapsed, the oxygen flow can be further reduced or may be discontinued if no untoward result is seen or discomfort is experienced, and there has been no significant change in the pulse rate

Oxygen may be given by means of a tent, by nasal catheter, or by mask Nasal catheter administration is the method most commonly employed The gas should be properly humidified to overcome the severe drying effect of the direct flow on the nasal and pharyngeal mucosae This can be accomplished by using water Because the presence of the catheter, acting as a foreign body, leads to its becoming encrusted with secretions, the catheter should be changed daily or twice daily

bronchial tree under direct vision by resorting to the passage of a bronchoscope is indicated

This procedure should be carried out by someone appropriately experienced in the use of these instruments Generally the procedure should be carried out in the recovery room or in the patient's own room without removal to an operating room Fully induced anesthesia, as for a diagnostic bronchoscopy, need not be insisted upon, and actually may be undesirable since coughing is a welcome result of the procedure Control of the gag reflex by applying 1 or 2 per cent Pontocaine or 5 or 10 per cent cocaine solution to the pharynx and laryngopharynx, and, perhaps, enough to the larynx by spraying to avoid the possibility of laryngeal spasm, is generally all that is required

A preliminary dose of the currently used narcotic may be useful in minimizing discomfort for the patient

A convenient method of carrying out the procedure is to place the back rest so as to bring the patient to Fowler's or semi-Fowler's position, the operator mounting the bed frame behind the patient and introducing the bronchoscope from this position

Miscellaneous Adjuncts In order to assure effective cough, relief of pain is paramount to be sure, but also proper attention must be paid to insure mechanical efficacy insofar as the bellows action of the chest is concerned Adequate ingress of air into the lungs is necessary to provide the proper propulsive force behind secretions in order to expel them Properly functioning systems of drainage and correct mediastinal alignment will generally insure the existence of these factors

Overly viscid secretions may be difficult to expel and the correction of this factor may be sought by (1) proper hydration and (2) administration of expectorants or detergents The latter include ammonium chloride and the iodides in the form of sodium or potassium salts (The latter named may not be desirable in tuberculous patients) Detergents, such as Alevaire, may be helpful and can be nebulized by oxygen or administered by hand-operated nebulizers Steam inhalation is often another valuable adjunct to treatment

At this point, a comment should be made about the use of atropine and its derivatives Belladonna or atropine does, of course, reduce bronchial secretion, but it must be remembered that it does so by reducing principally the water content while the amount of total solids remains essentially unchanged. This results in increased viscosity to the secretions, which is not generally desirable

Tracheotomy Occasionally, the performance of a tracheotomy may be required in order that very frequent endotracheal aspiration may

Fowler's position As a norm, it may be said that a systolic blood pressure reading of 100 mm of mercury or over in a semiconscious patient, who was normotensive originally and is quiet, is an acceptable level, particularly if the pulse rate is in the neighborhood of 100 or less

Falls in blood pressure levels call for a check on the pleural drainage systems (if present) to determine that they are functioning properly and, therefore, *insuring the physiological integrity of the ventilatory mechanisms*, as well as to indicate whether there is evidence of bleeding from within the chest If the results of this investigation are negative, then freedom from obstruction to the airway by secretions must be looked into and one should ascertain that an adequate oxygen supply is being delivered to the lung A reduced circulatory volume may then be considered and the matter of blood lost balanced against fluids given should be reviewed with *an eye to determining the need for additional blood to be administered* by transfusion Laboratory determinations, such as red blood cell counts, and determinations of hemoglobin and hematocrit values, are hardly reliable under the early postoperative circumstances and blood volume determinations are not generally available, or, for that matter, practical Thus, mature clinical judgment is the best source of opinion

Under the normal rate of evolution, the blood pressure and pulse rate should be stabilized by three to four hours after the operation, at which time the head of the bed can be elevated and kept up to a point of comfort, unless the change in posture adversely affects the blood pressure, demonstrating thereby its actual lack of stability

ARRHYTHMIAS AND CARDIAC FAILURE Cardiac irregularities are by no means uncommon after thoracic operations, particularly pulmonary resections Right-sided resections seem to be more vulnerable and pneumonectomies seem to be more likely to result in this situation than do lobectomies The irregularities range all the way from occasional extrasystoles to auricular fibrillation It is likewise of interest to realize that these irregularities often are transient The episodes of irregularity may be unnoticed by the patient or they may produce palpitation, dyspnea, weakness, faintness, sweating, and often a pronounced degree of apprehension

The transient episodes that are relatively asymptomatic call for no particular treatment Irregularities short of fibrillation, if symptomatic, can usually be managed by mild sedation Auricular fibrillation itself can often be controlled by sedation with relatively small doses of a barbiturate, although its frequently transient nature does not demand immediate action Even when recognized to be present for considerable periods of time, yet producing few or no symptoms, no urgency is felt about attempting to revert the rhythm to normal Persistence of fibrillation for three or four

The catheter should be so placed that its tip delivers oxygen into the pharynx just behind the soft palate

The use of positive pressure oxygen will rarely be found to have a place in the early postoperative period By its tamponading effect, oxygen under pressure can retard the transudation of fluid across the alveolocapillary membrane and can even, perhaps, reverse this direction of flow The most clear-cut example of this situation is found in pulmonary edema In the vast majority of postoperative patients, the moisture present in the tracheobronchial tree is a product of secretory activity by the cells of the tracheobronchial tree, or represents blood spilled there during the operative intervention This material, therefore, cannot be forced back into the circulatory bed across the alveolocapillary membrane Attempting to tamponade such material by positive pressure oxygen can only result in packing it deeper into the ramifications of the bronchi with obviously deleterious results

The Cardiovascular System

GENERAL CONSIDERATIONS In a patient whose blood losses at surgery have been properly replaced, who has a functionally intact chest wall, and has not been anoxic or hypercarbic during anesthesia, a moderate increase in pulse rate and a moderate fall in blood pressure are all that need be expected in the recovery period Under circumstances of high carbon dioxide retention during surgery, alarming falls in systemic blood pressure may be recorded postoperatively The tendency may be to consider this a picture of circulatory collapse, due to inadequate blood volume, when, instead, treatment should be directed toward support of the circulation by vasopressor drugs and oxygen administration This circumstance is best managed by the anesthesiologist and is most often encountered in the operating room immediately after termination of the procedure, while the anesthesiologist is still in direct charge of the patient This situation is, of course, lamentable and should not occur often, yet its importance seems to justify its being mentioned

Discussion, even though brief, of the above situation is important in calling attention to the fact that the administration of intravenous fluids of whatever nature can cause overloading of the circulation after lobectomy and, particularly, pneumonectomy

Actual blood pressure readings are, of course, of relative importance and should be evaluated on the basis of preoperative levels Also, the patient who is lying still can be expected to have a lower level than one who is awake or has been moving in bed A patient who is recumbent in the flat horizontal position will have a lower value than one who is in the semi-

Beyond the discomfort to the patient, emphysema is not serious of itself Its importance lies in the source of the air or in its progressive character The air remaining in the pleural space around an incompletely expanded lung or lobe may be forced through defects in the costal portion of the thoracotomy wound when the patient coughs, strains, or by other means increases the intrapulmonary pressure If no significant amount of the air expelled from the pleura is replaced by air leaks from the bronchus or lung parenchyma through the bronchial fistulae, the process is self-limited because the finally expanded lung or lobe will have displaced all of the air from the pleura and no further increments can, therefore, be added to the subcutaneous tissues

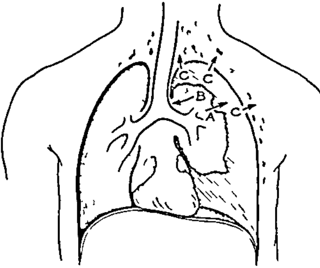

Fig 3 Common sources and portals for dissemination of tissue emphysema A, Lung defects, B, tracheal or bronchial defects, C, chest wall defects

If, on the other hand, air is poured into the pleural space through large bronchial leaks or an aggregate of many small alveolar leaks, the presence of emphysema is a serious problem, because it signifies actual or potential tension pneumothorax

Closure of the costal portion of the chest wall is often not mechanically air tight, and it need not be so, because adequate decompression of the pleural space by drainage tube or tubes provides a ready exit for pneumothorax air Supportive dressings applied so as to hold the extracostal tissues snugly against the costal line of incision generally complete a reasonable seal against significant air leak

Evidence, however, that air is entering the pleural space at a rate greater than it is being decompressed through the provided exits (drainage tubes), leading, therefore, to forced decompression into the soft tissues, is

hours, however, or any suggestion of cardiac failure demands immediate correction

The diagnosis of early cardiac failure is not easy to make after pulmonary resection, particularly pneumonectomy, because blood flow is increased through the remaining lung and signs of basal congestion, evidenced by moist rales, are to be expected This is also true, but to a lesser extent, following lobectomy An increase in respiratory rate that cannot be explained on other grounds, more than the expected moisture of the pulmonary base or bases, dyspnea and tendency toward orthopnea, some increase in tracheobronchial secretions and possibly a declining blood pressure should be taken to mean probable signs of cardiac failure The pulse will show a rising rate Gross irregularities in the pulse beat will, however, reduce the value of the pulse rate in evaluating cardiac failure

The occurrence of fibrillation is not to be minimized, but it need not be alarming if transient and not accompanied by inefficient cardiac action Any tendency to persist or to recur frequently, however, calls for efforts at correction Quinidine is the drug of choice to convert the rhythm, and can be given in an initial dosage of 6 grains followed by 3 grains every four hours In many cases, this will suffice to convert the rhythm Expert opinion should be sought in the more refractory situations and no time should be lost in doing this

If cardiac failure is suspected or present, digitalization is in order Here again, mature opinion should be sought without delay

Other measures that are available for consideration, but require mature judgment, and rarely are applicable in the first twenty-four or forty-eight hours postoperatively, include *phlebotomy* in patients with circulatory overload and the use of diuretics to reduce total fluid volume They can be effectively called upon to ameliorate the function of a failing heart, but are applicable in limited circumstances only

Cardiac failure in the absence of arrhythmia can and does occur, particularly after pneumonectomy The signs and symptoms are essentially as outlined above and the the treatment is, of course, proper administration of digitalis

Tissue Emphysema

SUBCUTANEOUS EMPHYSEMA The escape of air from the pleural space through the thoracotomy wound into the fascial planes of the extracostal soft tissues constitutes an alarming situation if the amount of air is great in volume Once the air gains access to these superficial planes, it will spread along them and may manifest its presence by distention of the areas involved, providing crepitus on palpation

such as by resection of two or more ribs or by fractures involving two or more ribs both anteriorly and posteriorly Likewise, fractures of ribs on either side of the sternum, for example, can render flail a portion or all of the sternum Thus, the involved portion of rib cage, being dissociated from the remainder of the rigid costal framework, is pulled in on inspiration by the negative intrathoracic pressure, sinking, consequently, as the rest of

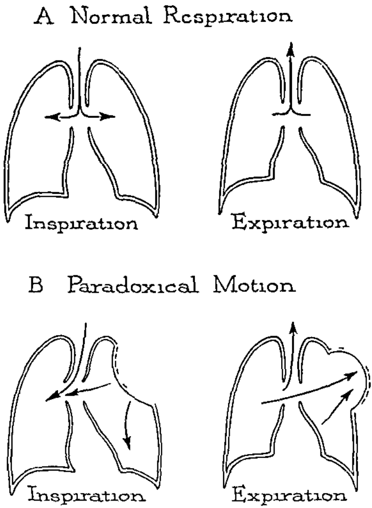

Fig 4 Normal respiration and paradoxical motion

the rib cage expands The reverse is true on expiration Such paradoxical motion renders breathing inefficient, cough ineffective and, what is even more important, can and does shuttle air back and forth between the lung underlying the flail portion of the chest wall and the other portions of the pulmonary tree This latter feature results in re-breathing, leading to decreased oxygenation on one hand and retention of carbon dioxide on the other Shock is the inevitable end result The development of a "wet lung" is a frequent sequela of extensive chest wall trauma

indeed indicative of a serious situation It is necessary under these circumstances to increase the rate of pleural decompression This can best be done by adding suction to the system of drainage, if this is not already present Leaks, and therefore emphysema, not controllable by this means will probably require reoperation to close the leaks at their sources

It is important in evaluating emphysema to realize that once air has escaped into the soft tissues at one point it can spread easily along fascial planes and, therefore, the mere presence of crepitus over a widening area of soft tissue need not mean worsening of the situation Assessment of this point requires observation over a period of time to decide whether there actually is more air under the skin or whether the same amount of air has merely spread over a greater area The tenseness of the tissues is a reasonably reliable guide

MEDIASTINAL EMPHYSEMA Whereas occasionally enough air can escape into the mediastinum to interfere with the venous return or even with breathing, it is a rare occurrence Decompression of such a tension pneumomediastinum by making an incision into the mediastinum through the suprasternal notch is mentioned for completeness The problem of mediastinal emphysema is fundamentally the same as that of subcutaneous accumulations of air

The dissemination of air in emphysema need not follow any preconceived plan based exclusively on anatomical arrangement of fascial planes, because most often there is air escaping into the subcutaneous planes as well as into the mediastinum Thus, in advanced cases, air appears in the neck producing a "bull neck" and, perhaps, in the retropharyngeal tissues, producing a nasal quality to speech, along the vascular sheaths in the arms, or along the femoral vessels in the upper thigh, aside from the muscular and subcutaneous planes over the thorax or even the abdomen Direct decompression of the subcutaneous space by needle aspiration is rarely useful, and, if possible (by virtue of the completeness of the air layer), is ineffective in light of the basic features of the problem

Paradoxical Motion of the Chest Wall

Paradoxical motion is taken to mean the circumstance by which a portion of the chest wall sinks on inspiration and rises on expiration, or, in other words, when the chest wall or a portion thereof moves in a direction *that is paradoxical or contrary to that of the normal or sound portion* The term generally refers to such occurrence in the costal chest wall, since this is the more obvious, but is actually applicable to the mediastinum and the diaphragm

Paradoxical motion is possible any time the rib cage loses its rigidity,

salt in the postoperative period, only minimal amounts of saline solution should be given, resorting principally to a 5 per cent solution of glucose in water, unless undue loss of electrolytes results from vomiting or other cause, which is uncommon Two thousand, or possibly 3000 cc of fluids in the first twenty-four or thirty-six hours is a top figure Somewhat less than this is generally sufficient to provide a urinary output of 500 cc or more for that period of time The danger of overloading the circulation is real Patients in the older age group will generally do better if they are kept definitely on the low side of normal hydration

Since minimal dysfunction of the gastrointestinal tract is expected in the chest surgical patient, early return to oral administration of both food and water is to be encouraged

Drainage Systems

WATER SEAL DRAINAGE It is almost universal practice to drain the pleural space after all thoracotomies except following pneumonectomy The empty pleural space following a pneumonectomy may, of course, be drained, depending upon the surgeon or the circumstances encountered at operation

The purpose of drainage is to provide ready exit for accumulations of fluid or blood which result from the surgical intervention and for the air remaining as a postoperative pneumothorax By so doing, the drainage provides a mechanism by which the remaining lung or portion thereof (lobe or segments) is favored in expanding to fill the hemithorax completely Prompt filling of the chest cavity by lung is essential and provides the greatest assurance against the occurrence of pleural complications

The drains employed are tubes whose walls will assure patency of the lumen by their noncollapsing character

Since free communication between the pleural cavity and the outside obviously cannot be permitted, the basic mechanical setup is a water seal In simplest design, the system implies that the chest tube is led from the pleura to a transparent glass container (for ready visualization of its content) where the end of the tube is placed under water The water bottle should always be at a level well below that of the patient's chest, and under no circumstances should the drainage or water seal bottle approach the level of the patient's chest unless the tubes leading from the pleura have been clamped off If the bottle is not placed at the appropriate level, the negative intrapleural pressure can pull or syphon fluid back into the chest if the distance between it and the water seal bottle is sufficiently reduced

It is advantageous to have glass tubing replacing the rubber tubing inside the water seal bottle, because then the degree of oscillation that ac-

A small amount of paradoxical motion, expressed either in the degree of the paradoxical excursion or the total area of chest wall involved, can be tolerated without serious inconvenience, as, for example, in thoracoplasty

Treatment is largely mechanical in the form of sand-bagging, having the patient lie on the involved side, or applying pressure dressings to prevent the swinging motion of the chest wall In extreme circumstances not controllable by any other direct mechanical method of stabilization, a tracheotomy may be done to reduce dead space in the tracheobronchial tree In desperate situations, placing the patient in a Drinker respirator must be considered Examples of the latter degree of severity need be expected only when the extent of the trauma was uncontrollable, as in injuries due to violence Balanced traction may be applicable in those cases produced by violence and especially when the breast plate had been rendered flail

Paradoxical motion of the mediastinum is usually corrected by adequate adjustment of intrapleural pressures and is not correctible by direct mechanical means Paradoxical action of the diaphragm follows interference with the phrenic nerve

Parenteral Fluids

Generally the patient arrives in the recovery ward receiving intravenous fluids of some description through one or more veins It is the intent of a good anesthetist to have replaced in equal volume, or nearly so, the blood lost during the operation Fluid losses otherwise are not great in amount, and the volume of intravenous fluids utilized to keep the systems patent, or to administer blood, generally is ample to maintain an adequate state of hydration If these circumstances have been fulfilled, and there is no reasonable fear that an emergency situation requiring rapid administration of blood will occur, when two intravenous routes are employed, one of them may be discontinued A patent needle or cannula in an ankle or foot vein is the preferable one to keep since this frees the arms for unhampered use by the patient

The remaining intravenous setup should be kept open by a slow drip of 5 per cent glucose in water This solution should be given thus until the patient has been able to drink, and it is relatively certain that serious nausea has passed and that vomiting will not occur If, at this time, no other use for an open intravenous needle can be foreseen, the needle may be removed

No clear limit as to the volume of fluid to be administered need be set The guiding principle should be to administer only that amount required to maintain adequate hydration Because of the tendency to retain

and character of the drainage, much information concerning the progress of expansion of the lung can be adduced This is especially true when an anterior (and usually superior) as well as a lower (and posterior) tube is in place X-ray examination of the chest in this period is generally limited, for practical reasons, to a frontal view, because a residual pleural space, that may be unfilled by lung anteriorly or posteriorly, may not be recognizable, yet, if either or both drainage tubes are still exhibiting free fluctuations, such a residual space is certainly present

It is important to realize that the patient's position in bed will usually affect the behavior of the water seals and should be taken into account in any interpretation With the patient semirecumbent, a remaining lower lobe or whole lung can be expected to fall down into the posterior gutter and, therefore, seal off a lower posterior drainage tube, causing fluctuations in it to cease Assuming an upright position may immediately free the lower tube. If a lower lobe has been removed, the lower tube may oscillate much longer than the upper tube

Fluid is expected to appear promptly from a lower tube Appearance of some fluid in the upper tube generally signifies the imminence of complete re-expansion, as the fluid that remains in the pleural cavity is spread around by the expanding lung to come within the drainage field of the upper tube Although such illustrations are given, they are to be used as guides and can in no way be considered absolute

SUCTION DRAINAGE In basic truth, the water seal constitutes suction drainage because it is a negative pressure system, sufficient to overcome the elastic recoil inherent in lung tissue, particularly when aided by periodic increases in intrapulmonic pressure produced by coughing, straining, and the like Thus, if the air within the pleura is not replaced by increments from bronchial or alveolar leaks, prompt and complete re-expansion of free lobes or lungs will occur with this mechanism alone

If significant leaks are present, as may occur after segmental resection, for example, the pneumothorax may be maintained beyond the ability of the water seal system to eliminate it Under such circumstances, increase in volume flow of pleural air to the outside is necessary in order to maintain the gradient of negative pressure within the pleura Many surgeons resort to this increase in negative intrapleural pressure as a matter of routine

Suction drainage has many modifications, but basically it includes a water seal next to the patient, and a suction-breaking device next in line The water seal is important in the event of a disruption in the system which would leave the patient's pleura open to the outside Obviously, the water seal bottle must have a tight-fitting cork in order to function properly in this setup (in contradistinction to the basic type of water seal previously

companies respiration, as well as the character of the drainage, can be seen Also, a section of glass connector is useful in the system at some point near the patient, because it provides a means of inspecting the character of the drainage as well as proving patency of the pleural tube if drainage flows into this "window" when the tubing distal to it is "milked" or "stripped" For best mechanical efficiency, each pleural tube should be connected to a separate water seal, in the event that more than one tube is used

The system as described then provides for egress of air or fluid from the pleural space and at the same time prevents ingress of air into it The tip of the tube in the water seal should be far enough below the surface of the water so that when water is drawn up into the tube on inspiration the tip of the tube will still be below water On the other hand, a tube placed too far below the surface of the water will increase unnecessarily the degree of

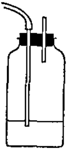

Fig 5 Simple water seal drainage

pressure required to expel air or fluid through the tube A water seal bottle providing ample surface area of water will be more efficient than a narrower one Also, the container should be capable of accommodating a minimum of 400 to 500 cc of drainage over and above the initial water content If drainage is copious, readjustment of the tip of the drainage system with respect to the fluid level may be required, although in the average case this is not necessary It is also practical to place a mark on the bottle or utilize a means of gauging the amount of drainage This is particularly valuable if sudden increases in the fluid occur, in which event active bleeding from the pleura must be considered

This simple drainage system provides a means of escape for the pleural content postoperatively, yet re-establishes the mechanical integrity of the intrathoracic pressure gradients, and usually suffices to bring about prompt re-expansion of a lung or lobe

By carefully following the behavior of the tubes, noting the amount

bottle, but open to the outside Water is placed in the jar and allowed to rise along the tube to a level such that the distance between the lower end of the open tube and the surface of the water is the same as the degree of negative pressure desired measured in centimeters of water Thus, when suction is applied, the level of water within the open tube will sink in proportion to the amount of negative pressure in the system If a maximum of 15 cm negative pressure within the system is desired, the distance between the lower tip of the tube and the surface of the water should be 15 cm When such levels of negative pressure are reached, the level of water will have sunk to the lower tip of the tube and any increases of negative pressure beyond that will draw air into the bottle through the tube from the outside, automatically breaking the suction at this level It is, therefore, apparent that failure to have the break bottle bubble at some time during the respiratory cycle means that the desired degree of negative pressure or suction has not been achieved and the reason for this failure should be investigated The causes are (1) inadequate capacity of the pumping unit, (2) air leaks along the system of bottles and connectors and (3) air leak into the pleura that is greater in volume per unit time than the volume of air that the pump can displace in the same period of time It is important to distinguish between reasons (1) and (3) because reason (1) refers simply to a weak pump that is incapable of producing the desired degree of negative pressure, whereas reason (3) implies a serious air leak within the pleura The differentiation between these two situations can readily be made by placing a clamp at the chest wall on the tube leading from the pleura to the first bottle in the system, the water seal If the pump can produce the desired degree of negative pressure, as evidenced by bubbling through the suction breaker bottle, both the adequacy of the pump and the air-tight nature of the system are assured up to the point of the clamp Evaluation of the extent of air leak within the pleura from bronchial or alveolar openings is a difficult problem It calls for mature judgment born of experience and can hardly be detailed here It must be remembered, however, that a large amount of residual air within the pleura that is replaced slowly by small air leaks may cause the pump to work for some period of time before it can catch up with the situation Also, it is not imperative that the suction-breaking mechanism bubble continuously to give assurance of adequate functioning of the system The purpose of the method is to increase the intrapleural negative pressure and this need not necessarily be carried to the high level set Again, the adequacy of such a situation is decided by mature judgment based upon the nature of the surgery that was performed, the extent of bronchial leak expected or present, and other factors

Beyond these two bottles described, a simple trap bottle may be

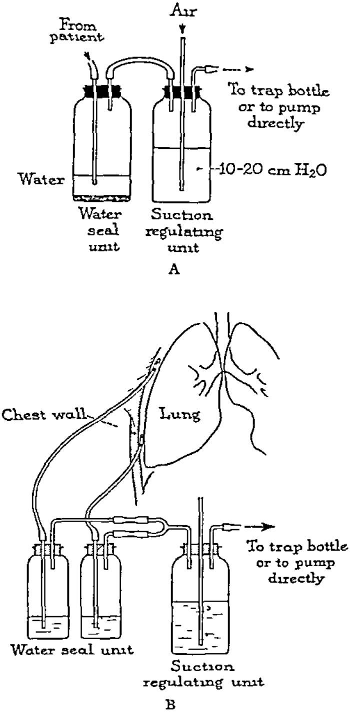

Fig 6 Suction drainage A, Single water seal, B, completely assembled unit

described, which requires merely the maintenance of the tip of the pleural tube under water) The purpose of the suction-breaking device is to regulate the maximum amount of suction applied to the water seal bottle and, therefore, to the pleural space The device consists of a portal for the application of suction and another glass tube reaching near to the bottom of the

to water seal bottle, I am against reversing this by irrigations or instillations as a matter of routine Under certain situations, it may be proper procedure to do so, but I consider it to be meddlesome otherwise Efforts should be concentrated on maintaining patency of the tubing and encouraging the impetus of flow from pleura to water seal

CHARACTER AND QUANTITY OF DRAINAGE The trauma of surgery and the blood that is spilled into the pleura constitute irritants to which the pleura responds by an out-pouring of varying amounts of fluid Basically this effusion is serous in nature and dilutes the blood Although intervening factors, such as severe bacterial contamination or other less well-understood influences, may occasionally alter the character of this effusion to render it heavier in fibrin and lead to clotting, such an occurrence is not common, except following wounds of violence

Thus, the fluid evacuated from the pleural space during the first few hours following surgery is clearly bloody in character, tending to become serous by the end of thirty-six or forty-eight hours as new increments of blood cease and the pure reactive effusion predominates The exact proportion of blood and serum and the speed of the transition may vary widely The important factor to be considered early, of course, is the actual volume of whole blood in the drainage

It is particularly important to note if a rather sudden increase in the amount of drainage, not accounted for otherwise, occurs This observation accompanied by signs of lowered circulatory volume, such as a falling blood pressure and rising pulse rate, tends to confirm the suspicion of continued bleeding into the pleura The crucial decision from the standpoint of management concerns the necessity of reopening the pleura to secure hemostasis The alternative plan is to retransfuse and observe further, on the assumption that there is no manageable source of bleeding for which direct surgical attack is justified The more common vessel responsible for postoperative bleeding is either an unsecured bronchial artery or an intercostal vessel wounded during the closure If a more or less accurate estimate of the proportion of whole blood in the drainage is desired, determination of the hemoglobin content will generally suffice Red blood cell counts may not be reliable because of laking Detritus of various kinds may give a false hematocrit reading on pleural drainage Darkening of the color of the drainage to a brownish fluid or lightening of its color toward pink will likewise assure the observer, in course of time, that active bleeding is not present

REMOVAL OF TUBES Although usually not pertinent to the postoperative period spent in the recovery room, the method of removing tubes may be advantageously discussed

placed between the pump and the suction breaker to protect the pump from wetting, in the event of a spillover from whatever cause The final unit in the system is, *of course, a source of suction*

CARE OF DRAINAGE TUBES Tubes should be securely anchored at the time they are placed To prevent kinking and to guard against undue traction by accidental tugging, they should be fixed to the dressing by adhesive tape A convenient method is illustrated in Figure 7 It is also advisable to secure all connectors by a narrow strip of adhesive tape running from rubber to rubber This will not reduce visibility at this "window," yet

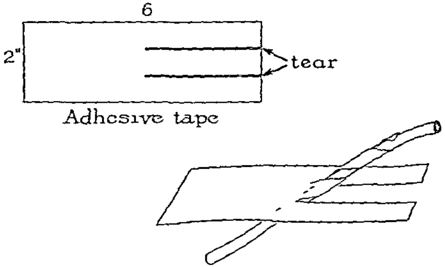

Fig 7 Method of fixation of drainage tubes

makes the possibility of the system being pulled apart unlikely Some type of clamp should be available to occlude each tube immediately, should a disruption in the system occur

Tubing should be just long enough to permit care of the patient in bed with room enough for the patient to turn or sit up with slight slack, but no excess length is advisable because it merely increases the volume of dead space within the drainage system It is a good idea to support the tubing to the edge of the bed in some fashion in order to reduce tugging by the mere weight of the tube falling free

Tubing should be checked for patency by observing oscillations within it, or by the free passage of drainage When these signs are not evident, or just as a matter of routine at each check of the patient's condition, the tube should be milked by stripping it toward the drainage bottle It is also advantageous to do this with the patient sitting up as well as recumbent, particularly after the first twelve hours or so of the postoperative period

Since the desired direction of flow in the drainage tubes is from pleura

General Nursing Routines

POSTURE OF THE PATIENT Patients with thoracic disease or injury are most comfortable in semi-Fowler's position While unconscious, they, of course, should be kept horizontal The Trendelenburg position is not only unnecessary, but undesirable because of the reduction in vital capacity produced by the encroachment on the thorax by the gravitating abdominal viscera

When consciousness returns and the blood pressure is stabilized, the more vertical posture is desirable The patient should be turned frequently and may assume any position that is comfortable However, it is perhaps best to encourage the pneumonectomy patient to lie on the side upon which operation was performed or on the back This postural restriction is occasioned by the fear that should the bronchus open when the side which has been operated upon is uppermost, the fluid contained in that hemithorax may pour into the contralateral side This fear may be somewhat exaggerated, but the precaution seems reasonable When lung tissue remains on the side which has been operated upon and drains are in place, the patient may lie on either side, but the presence of the tubes makes the side operated upon less comfortable

AMBULATION AND MOBILIZATION Resumption of activity is indicated at the earliest possible moment As soon as the circulatory system has become stabilized, the start should be made toward the upright position The position should be changed frequently from back to side, and the patient should be encouraged to undertake as much of this on his or her own power as seems reasonable The arm on the side operated upon should be exercised actively as early as the patient will do so Sitting up in bed with help is desirable within the first twenty-four hours, and by the end of twenty-four hours following operation it is desirable to have the patient sitting up in bed with the feet dangling over the edge for periods of a few minutes at a time

I have preferred to carry out early mobilization thus in bed in any patient with drainage tubes, because attempts at more extended ambulation out of bed may result in complications involving the attached mechanical systems After the tubes have been removed, I allow full freedom, even in patients having resections for pulmonary tuberculosis Patients who have no drains may be allowed out of bed as soon as it seems acceptable to the patients, and this includes patients who have undergone a pneumonectomy

There seems little justification in preventing a willing patient from free mobilization except for the mechanical restriction of drainage tubes Reticent patients should be allowed a somewhat slower schedule, unless it

Thoracotomy tubes are ready for removal when their presence is no longer required This occurs when the lung or lobe is fully expanded as determined by x-ray examination and by the cessation of fluctuation in the system Further considerations include the amount of drainage as well as its character Dark bloody fluid lying in the tubing can generally be expected to be replaced by lighter or serous type fluid over the succeeding twelve to twenty-four hours, and justifies leaving the tubes in place Even though a clot may have developed in the tube, this further drainage can seep around it and the drain is, therefore, probably effective for a short while longer Accurate estimates of drainage are unnecessary, and direct measurements, except perhaps by direct calibration on the water seal container, are to be discouraged, but definite persistence of detectable amounts of drainage call for leaving the tubes in longer if other criteria may have been satisfied, particularly after segmental resections or lobectomy It is generally not desirable to remove tubes much under forty-eight hours, but they should certainly be removed in five or, at the most, seven days A tube lying in one track for longer than six or seven days seems to invite infection even though antibiotics have tended to increase this "period of grace"

To remove the tube from the pleura, the dressings and other anchors to the tube at the chest wall are freed, with the patient lying on the side upon which operation has not been performed The operator stands at the patient's back Before the final anchoring suture is cut, a ball of gauze some 2 inches in diameter is prepared from two or three 4- x 4-inch gauze sponges Also in easy reach, three or four strips of adhesive tape 2 inches wide by 6 or more inches in length are made available The tube is then freed, and held in one hand, the wad of gauze being grasped by the other hand With a slight rotary motion to disengage the tube, it is quickly pulled from the chest while the gauze pad, which is being held firmly against the chest wall at the tube site, is pressed down to seal off the skin opening and tube track The gauze pad is then taped down snugly to maintain occlusion of the tube track through the chest wall No sucking of air should occur

Care of the Wound

Properly made and closed thoracotomy wounds heal kindly and no special attention need be directed toward them They are inspected when the tubes are removed and, finally, when the sutures are removed

Antibiotics

These are used at the discretion of the surgeon and offer no special problem

antibiotic coverage, of course, has to be specifically directed from the standpoint of the drugs in use

The attendants waiting on tuberculous patients should be provided with the necessary gowns, caps, masks and gloves required for their own protection

Operations on the Chest Wall

Many of the operations on the chest wall faded from practice because they were done for chronic empyema or other forms of chronic suppuration They implied generally that the pleural space was obliterated beneath the area of operation, otherwise they would have been in actuality intrapleural operations

The basic physiological derangement to be considered in most or all of the subjects was instability of the chest wall When stiff-walled empyema spaces were unroofed, no appreciable problem was created because the degree of paradoxical motion under the resected chest wall was not significant In extrapleural thorocoplasty, excessive decostalization can, of course, produce this problem The important features earmarked for attention postoperatively in a thoracoplasty patient, therefore, are (1) control of paradoxical motion and (2) careful insistence on evacuation of secretions by cough, particularly in the tuberculous patient, in whom this procedure will find its chief indication

Should, by accident, the pleura have been opened during the operation, attention must be directed to the pneumothorax in the postoperative period Under such circumstances, most surgeons will have placed an intrapleural catheter connected to a water seal Management of this phase then becomes similar to that of the thoracotomy patient in whom the lung remains intact If a catheter has not been placed in the pleura, the extent of pneumothorax must be evaluated by x-ray examination and reduced by thoracentesis The progress of the situation will require follow-up x-ray studies

Operations within the Pleura

SIMPLE THORACOTOMY When the chest is opened but no surgical intervention is carried out on lung or other intrathoracic organ, the postoperative management is elemental and will be described as a basic type into which variants may be introduced as the operative interventions become more complex

The unconscious patient will be placed flat in bed, lying supine or in the lateral decubitus position Oxygen will be started by nasal catheter at a flow of 6 to 9 liters per minute, the gas being bubbled through an appropriate humidifier The drainage apparatus (usually one pleural drain tube

seems certain that the reticence is due to timidity This should be gently but firmly overcome by personal assistance, demonstrating the safety and feasibility of ambulation

GASTROINTESTINAL DISTURBANCES Nausea and vomiting under modern practices in anesthesia are absent or short-lived and cause only temporary inconvenience Gastric distention is likewise rarely a problem in pulmonary or mediastinal operations Air-swallowing or the introduction of oxygen into the stomach consequent upon a poorly placed nasal catheter may, of course, require decompression by Levin tube

If nausea persists, mild sedation with a barbiturate or use of a drug such as Dramamine orally or parenterally may be necessary Belladonna should be used cautiously because of its undesirable effect in patients by inspissating bronchial secretions

Evacuation of the rectum need not be sought for two or three days The use of mineral oil at bedtime, ambulation out of bed and a prompt return to a full diet generally result in spontaneous evacuation in reasonable time without resort to more artificial methods of inducing bowel movement

URINATION Catheterization of the bladder may be required in some patients, but if position in bed seems to be responsible for failure to urinate (in male patients), the patient may be allowed to stand by the bedside with assistance to accomplish this Catheterization of female patients is probably more expeditious in the first twenty-four hours than is utilization of a bedside or portable commode to achieve the advantage of the accustomed position The quantity of urine should be recorded for two or three days after operation, as well as its gross appearance The first one or two voided or catheterized specimens should be analyzed chemically and microscopically There are no urinary difficulties peculiar to thoracic surgical patients

SPECIAL CONSIDERATION IN SPECIFIC TYPES OF THORACIC SURGICAL PROCEDURES

Tuberculosis or Other Contagious Diseases

Patients with tuberculosis or other contagious diseases are not admitted to general recovery rooms, being managed usually in specialized institutions In general hospitals, they are taken to private rooms or specially designated recovery areas Their care in the immediate postoperative period differs in no fundamentals from that of patients having lobectomies, pneumonectomies or segmental resections for nontuberculous diseases The particular problems of patients having thoracoplasties, principally parodoxical motion of the chest wall has been discussed previously The program of

antibiotic coverage, of course, has to be specifically directed from the standpoint of the drugs in use

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will suffice) will be checked to insure against it being kinked It will be properly supported and the level of fluid in the water seal bottle will be noted The blood pressure reading and pulse rate will be recorded The color of the patient, the presence or absence of sweating and the temperature of the extremities as determined by palpation will be noted The amount and type of intravenous fluid received by the patient will be ascertained and any intravenous solutions currently being administered will be checked It is well to inquire of the responsible surgeon or anesthetist as to any special problems to be anticipated or guarded against

This general and more or less routine postoperative observation continues with the check on pulse rate and blood pressure reading every ten to fifteen minutes for the first hour, and at lengthening intervals as stability of the cardiovascular system is demonstrated

When the patient regains consciousness, restlessness and/or pain may become the pertinent problem Narcotics in moderate dosage may be given Morphine sulfate or Demerol may be tried The dosage should be adjusted over the next several hours to provide adequate relief of pain, yet not produce any significant degree of lasting narcosis Sleep or drowsiness *resulting from the relief of pain is, of course, acceptable*

When this stage of recovery is reached the routine of coughing should be instituted Every hour and one-half or two hours, the patient should be aided in and commanded to cough, the attendant insisting that the effort be productive if at all possible The patient may be turned also at frequent intervals, particularly to a position of reasonable comfort and convenience if vomiting happens to be a problem

By this time, a sufficient check on the blood pressure reading and pulse rate will have permitted recognition of their stability When they have become stable, the head of the bed may be elevated to an acceptable level and kept there unless the blood pressure is adversely affected by the change in posture, in which case the move will be postponed and tried again somewhat later

When the patient has fully reacted, attention may be directed to weaning away the oxygen as previously described Unless otherwise indicated, intravenous fluids can be discontinued if the patient is no longer nauseated and has demonstrated the ability to retain water by mouth in appreciable quantity, or when the patient has voided urine Food and fluids may be offered as desired or tolerated The temperature will have been taken at the first convenient opportunity postoperatively, preferably by rectum for the first twenty-four hours, and will be checked every four hours thereafter

The speed with which these various steps are undertaken varies from

individual to individual, but as a matter of routine should be carried out as speedily as circumstances permit

If voiding does not occur spontaneously, catheterization may be resorted to as indicated Permission may be granted male patients to stand beside the bed on the side of the water seal to void, but, female patients and males able to use the urinal while lying in bed should be kept in bed as long as drainage tubes are inlying

By the end of twenty-four hours, minimal or no fluctuation is seen in the water seal, and the drainage should be serous or the entire system may be empty if complete lung expansion has occurred very rapidly The patient should have been sitting upright in bed and have dangled the feet over the bedside at least once The chest should be checked by x-ray examination on the morning following operation (Some surgeons check this the same day of the operation) An x-ray picture taken with a portable apparatus is preferable, thereby avoiding the hazard of transporting a patient with clamped-off drainage tube, or of transporting the drainage system along with the patient, to a fluoroscope or x-ray department The x-ray film exposed in the portable machine will provide the necessary information It should be exposed with the patient in the upright position The most satisfactory method is to have the patient sit on the edge of the bed, dangling his feet over the side onto a chair, while embracing the properly positioned x-ray cassette The x-ray machine is positioned so that a posteroanterior film is obtained A lateral exposure can be made, but is not deemed necessary

The x-ray film should be read promptly so that any changes in management indicated by the presence of atelectasis, failure of expansion, or significant accumulations of undrained fluid can be corrected without delay

The second day should see full freedom in bed, and a generous range of motion for the affected arm is expected Pain will be relieved judiciously and coughing insisted upon The drainage tubes may be removed under ideal circumstances, but this is probably best delayed another twenty-four hours because some output of fluid can still be expected A daily check by x-ray examination is insisted upon by many surgeons as long as the drainage tubes are in place Careful observation of the behavior of the water seal bottles and a periodic check by x-ray film is, however, adequate in the minds of many

When the tubes have been removed, ambulation out of bed may be allowed freely Evacuation of the lower bowel need cause no concern Spontaneous bowel movements are usual after two to three reasonably full meals have been ingested and the patient has become ambulatory Use of mineral oil by mouth at bedtime on the third day will render the first

passage easy Enemas of soapsuds or oil retention enemas may be used when indicated if spontaneous evacuation fails to occur

LOBECTOMY The basic management is the same as for simple thoracotomy A longer delay in filling of the chest cavity by remaining lung tissue may be expected, of course If an upper lobe has been removed, the upper tube (two tubes are usual) will cease fluctuating last and the lower tube *will actually fluctuate but little, evacuating principally the bloody* pleural fluid This is as might be expected, since the base can be filled more promptly by lung remaining in that area

When a lower lobe has been removed, one tube only may suffice At any rate, the principal functioning tube will be the lower one, evacuating both air and fluid as a rule

SEGMENTAL PULMONARY RESECTION The basic management is again the same as for thoracotomy and lobectomy Air leaks are more frequent and deposition of clotted blood more likely along the raw segmental surfaces following this procedure than after thoracotomy or lobectomy These will require suction drainage more often and some surgeons institute this immediately It is the contention of many that immediate institution of high negative pressure to the pleural cavity may tend to keep open some of the air leaks which would seal, if not placed under such stress Therefore, some surgeons use the gentler water seal drainage for the first twenty-four hours If the first x-ray examination does not show virtually complete re-expansion, or if important air leaks are still manifested at this time, suction drainage is instituted

PNEUMONECTOMY At the conclusion of the operation, after turning the patient to a recumbent position and during quiet breathing, the intrapleural pressure is determined on the side operated upon and should have been adjusted to a physiological negative state This determination may be made by utilizing a pneumothorax apparatus No provision for drainage is made in the average patient, the chest being closed tightly

Postoperatively the basic regimen is the same as that described for partial pulmonary resections with certain exceptions

1 The amount of fluids and blood given intravenously should be more closely adjusted to avoid circulatory overloading Rales are generally to be heard over the remaining lung and increased blood flow is evidenced on the x-ray films by prominence of the vascular markings The condition is commonly referred to as "congestion" The increased blood flow lasts from two to four days, by which time the necessary circulatory readjustment has taken place and more nearly normal mobilization of the fluids in the pulmonary bed is taking place Persistence of the increased flow for a longer period of time should suggest some failure of cardiac compensation

If tachycardia and some dyspnea continue, control of the situation by diuretics and/or digitalization is to be considered Salt should be restricted The opinion of an experienced cardiologist is in order under these circumstances

2 Since there is no lung to fill the hemithorax, this space is occupied by an effusion, and accumulation of fluid faster than the air is absorbed leads to increases in intrapleural pressure This will shift the mediastinum toward the good side, reducing thereby the ventilation that is possible in that lung Thus, the pressures in the pleural space should be checked whenever there is any suspicion of significant changes therein Estimation and adjustment of intrapleural pressures need not be done oftener than every forty-eight hours if the subject remains comfortable These pressures can best be estimated and adjusted by inserting a hollow needle in the second anterior intercostal space while the patient is in a comfortable semi-Fowler's position in his own bed Use of a pneumothorax apparatus renders the procedure accurate More experienced operators may rely on estimation of the degree of negative pressure by the behavior of the plunger in a 5- or 10-cc syringe whose needle is in the pleura The use of such a syringe may be expedient if antibiotics are placed in the pleura every forty-eight hours, as is the recommendation of some surgeons

3 In the absence of a drain, the patient may be allowed out of bed as soon as this is tolerable The average well-compensated patient will be willing to sit in a chair by the second or third day

4 The patient probably should not be allowed to lie on the side which has not been operated upon, that is, he should not lie with the vacated, but partially fluid-filled hemithorax uppermost In this position, a bronchial leak might cause flooding of the remaining lung, should an opening occur with unusual suddenness

Transpleural Mediastinotomy Since the lung is intact, the immediate postoperative management is the same as that following simple thoracotomy The later problems that may arise in the area of operation within the mediastinum are beyond the scope of this work

Sternal-Splitting Incisions If the pleural spaces are not entered during the operation, the management is essentially as that following operations on the chest wall If one or both pleurae have been entered, management will then be determined by the existing circumstances and reference should be made to the section on simple thoracotomy

Thoracotomy with Block Resection of the Chest Wall This situation combines the problems of chest wall instability with those of thoracotomy, and to these may be added the problems implied by some resection of lung

The one outstanding feature of such cases is that postoperative x-ray films are usually very difficult to interpret with certainty because of the distortion of the chest wall

Fluid accumulations are confusing because they may occur in extracostal portions of the chest wall, yet appear to be intrapleural Such aspects of these problems must obviously be individualized

OPERATIONS ON THE BRONCHIAL TREE Except for the increased possibility of delay in pulmonary re-expansion or increased severity of air leak, the problems presented following bronchial tree surgery are composites of the problems presented following other and simpler chest operations

THORACOTOMY OR LOBECTOMY WITHOUT DRAINAGE Even though in the great minority, an occasional surgeon will not employ drainage following thoracotomy or lobectomy Withdrawal of air or fluid from the pleura must be accomplished by thoracentesis, and the necessity for this must, in most instances, be determined by serial x-ray examinations

MANAGEMENT OF ACUTE TRAUMA The management of patients with thoracic wounds or injuries due to trauma is basically the same as the *management of persons whose wounds or injuries were surgically produced* The one principal difference lies in the difficulty of recognizing the exact extent of the damage in the traumatized patient as opposed to the postoperative patient in whom the extent of morbid changes has been intentionally brought about Thus, all of the avenues of therapy discussed in the care of the postoperative patient are essentially applicable to the patient with accidental injuries of the thorax

There are three guiding principles or concepts which should direct the approach to management

1 Management is basically conservative

2 The most important factors militating against recovery of the patient are pain and disturbed cardiorespiratory physiology

3 All complex thoracic wounds can be analyzed and broken down into fundamental entities Correcting each such fundamental derangement generally results in the synthesis of a successful program of therapy Thus, an open hole in the chest wall, with air and blood in the pleura, constitutes an open hemopneumothorax Closure of the hole leaves a hemopneumothorax Aspiration of the blood leaves only a pneumothorax Finally, elimination of the air restores the situation to normal Even though this is obviously a gross oversimplification, such an analytical attitude is important to acquire because it provides the basis for a clear understanding of complex situations and points the way to management

Evaluation of the extent of injury is accomplished by physical and x-ray

examinations The physical examination is directed to three main points

1 The degree of shock This will immediately indicate the appropriate steps to be taken in order to maintain life while a more definitive analysis of the situation is carried out

2 Stability of the bony cage Control of paradoxical motion is mandatory

3 Wounds communicating with the pleura and sucking air must be closed by an occlusive dressing The wounding instrument and its potential course should be considered as a clue to hidden damage

The x-ray examination must often be limited to a film exposed in a portable apparatus, but this suffices to reveal the presence and extent of pneumothorax, hemothorax, enlargement of cardiac silhouette, and the like

With this background, the various entities are managed as they are recognized according to the principles outlined for care of the postoperative patient Direct surgical intervention is to be considered only in exceptional circumstances, save for attention to the soft tissue wound which is managed just as any wound elsewhere would be Sucking wounds are cleansed as required, being debrided and closed after it has been ascertained that no bleeding continues from an intercostal or other subjacent vessel

Thoracotomy is indicated only under the following circumstances

1 Wounds involving the mediastinum, the posterior mediastinum particularly

2 Wounds that involve the diaphragm

3 Tension pneumothorax not controlled by intercostal catheter decompression

4 Continued intrapleural bleeding not controlled by debridement of the chest wall wound

These broad categories of indications for direct surgical intervention cover such circumstances as wounds of the esophagus, trachea and bronchi in the mediastinum The possibility of combined injury to upper abdominal viscera is surmised when the diaphragm is involved Wounds of the great vessels are ordinarily fatal before definitive care can be made available, but must be considered when intrapleural bleeding continues from an undisclosed source The diagnosis of continued intrapleural bleeding is difficult to establish A severe increase in the amount of pleural fluid over a period of time can be due to effusion poured out as the result of the trauma and/or blood spilled into the pleura originally This fluid may be grossly bloody, but determination of its hemoglobin content will show that it is

not whole blood Thus, to be sure that bleeding continues actively from some intrathoracic source, the pleural content must reaccumulate at a rather rapid rate and the fluid aspirated must conform in hemoglobin content to whole blood

The lung is not a likely source of active bleeding in significant amounts because of its propensity to become hepatized when wounded

Heart wounds generally require direct operative intervention in order to close the defect in the myocardium and prevent death from pericardial tamponade In the smaller wounds, particularly those produced by noncutting instruments, such as ice picks, the accumulation of intrapericardial blood may tend to stop the flow of blood from the heart Thus, if by occasional withdrawal of blood from the pericardium by aspiration, a fatal level of cardiac compression by tamponade can be avoided, and, at the same time, fresh active bleeding is not incited by the maneuver, conservative management can be successful Decision here, however, requires mature and experienced judgment While the operating room is being prepared for direct surgical intervention, decompression of life-threatening tamponade by pericardiocentesis may preserve life and make definitive treatment possible

MINOR SURGICAL PROCEDURES DURING THE POSTOPERATIVE PERIOD

Thoracentesis

Thoracentesis is utilized to remove air or fluid from the pleural cavity and consists basically of introducing a needle attached to a syringe into the pleural cavity The site of puncture is determined by the location of the material to be aspirated Since fluid is generally found in the dependent portion of the pleural cavity, the usual site of puncture is the seventh or eighth intercostal space in the posterior axillary line In pleural disease, because of the elevation of the diaphragm, no appreciable extent of the pleural cavity is apt to be found below this level posteriorly, or below a line running forward to the corresponding nipple Within an area of the chest where the presence of fluid is suspected by the appearance of the x-ray film, it is usually advisable to place the needle at the spot where the absence of, or greatest decrease in, transmission of tactile fremitus is found on physical examination

The patient may be placed in any convenient position, but generally the sitting position is most advantageous By elevating the head of the bed, this can generally be achieved easily, and aspiration of the anterior or lateral portion of the chest can be carried out without further displacement of the patient To aspirate posteriorly, the patient may be turned so as to have his feet dangling over the edge of the bed and supported on a chair, and the

sound side of the chest can be allowed to rest against the elevated head of the bed or further propped up by pillows It is, thus, highly practical to carry out this procedure without moving the patient from his bed

The essential steps in a thoracentesis are given below

1 The appropriate field is selected for the site of puncture

2 An adequate skin field is prepared around the site selected for puncture

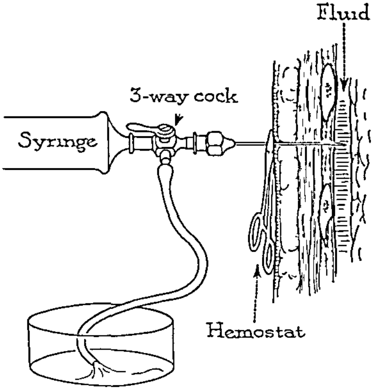

Fig 8 Thoracentesis performed with syringe, needle and stopcocks

3 Utilizing a 5- or 10-cc syringe and a 1 per cent solution of procaine, a skin wheal is produced at the site of puncture, being centered over the elected intercostal space A hypodermic needle is suitable for making the wheal

4 Changing to a larger (2-inch) needle of greater caliber, the skin wheal is pierced and the needle is advanced to the level of the rib cage Additional amounts of procaine should be injected as the needle advances A rib may be encountered or may actually be sought for with the needle point to determine this level, although such a maneuver is not necessary, and after some practice the level of the intercostal space can be gauged accurately without it

The intercostal muscles are entered with the needle and well infil-

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the needle, stopcock and syringe This consists of introducing the needle into the pleural space, the needle being attached to a length of rubber tubing and the tubing then attached to the syringe Each time the syringe is to be emptied, the tubing will be clamped by a suitable hemostat, and the syringe disconnected and evacuated in the proper container In order to stabilize the needle at the skin, a hemostat is placed on the needle flush with the skin It is obvious that the use of the three-way stopcock in the rigid system is much more efficient and, therefore, more practical

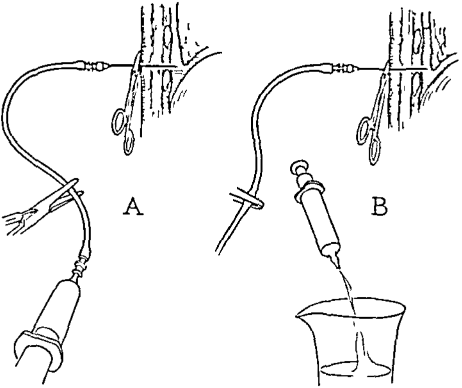

Fig 9 Thoracentesis performed with needle connected with syringe by rubber tubing

Determination of Intrapleural Pressures

This is carried out essentially in the same manner as a thoracentesis except that a site for puncture should be selected where fluid, if present, will not be encountered because, if fluid enters the needle or stopcock, fluctuations in pleural pressures may not be transmitted to the manometer Thus, the second anterior intercostal space is the site usually selected for puncture with the patient in semi-Fowler's position Preparation of the skin and anesthetization of the skin and pleura are carried out as for thoracentesis

A separate needle, syringe and three-way stopcock are connected to

trated with procaine in order to insure adequate anesthetization of the pleura The needle is now advanced slowly, accompanied by further injection of procaine As it is estimated that the pleura is approached, traction can be maintained on the plunger of the syringe after a good dose of procaine is placed right at the pleura if this is possible With traction on the syringe as soon as the pleura is entered, the pleural fluid or air will appear in the syringe

5 If any appreciable amount of the fluid is believed to be present, it is advisable to remove the anesthetizing syringe and needle A larger syringe of 30- or 50-cc capacity is now connected to a three-way stopcock and a needle is placed on this in turn, so that the syringe and needle are in a straight line The side vent of the stopcock will be used to discharge the aspirated material and a length of rubber tubing fitted to the side vent will transport this fluid to a suitable container It is well to test the assembled apparatus so as to be sure what position the lever of the stopcock should be in, in order to connect needle and syringe and then the syringe and discharge tube Also, all connections should be snug so that no air will be admitted

The needle is now inserted into the pleura along the previously anesthetized track, with traction on the plunger, to again determine the moment of entry into the pleural cavity At this depth, it is convenient to secure a hemostat to the needle flush with the skin This tends to stabilize the apparatus and avoid the undesirable advancing and withdrawing of the needle that might be produced by the pulling and pushing as the syringe is filled and emptied Needless to say, all apparatus must be sterile and the entire procedure is carried out under strict asepsis

Fluid may be withdrawn until the space is evacuated If large amounts are present, however, the procedure should be stopped when discomfort to the patient is produced Onset of coughing should be a signal that sufficient fluid has been removed at that particular operation These events are taken to mean that the lung has not been able to expand to compensate for the volume of fluid withdrawn and undue negative pressure is being created in the pleural space, causing displacement of other intrathoracic organs, notably the mediastinum and/or diaphragm

Air replacement may be used to equilibrate the intrapleural pressures under these circumstances, but, in most instances, is not desired because it defeats the prime purpose of the procedure, which is to obliterate, by emptying, the pleural space

Minimal or no dressing is required after the needle is withdrawn

There is another method of performing a thoracentesis which avoids the use of the stopcock as well as the use of the rigid system consisting of

anterior intercostal space or in the fourth intercostal space in the axilla The procedure can be carried out with the patient in his bed

The skin is prepared about the proper site and the chest wall is anesthetized as described for preparation for thoracentesis A small incision is made in the skin with a knife blade, so that the trocar shaft will not be gripped by skin that fits it too snugly The trocar with its inlying sharp-

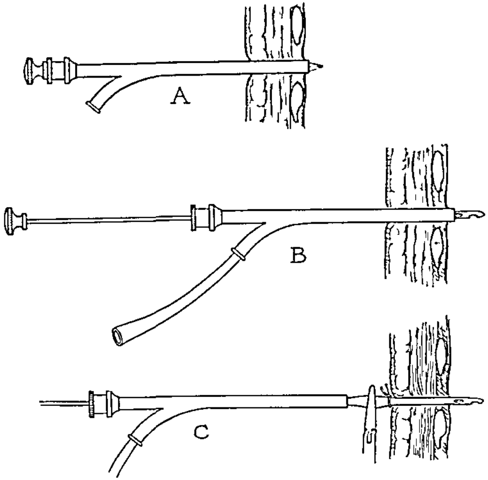

Fig 10 Insertion of thoracotomy trocar into pleural cavity

pointed stylet is then inserted into this incision in the skin and is advanced along the anesthetized track passing between the ribs A rotary motion will aid in the steady advance of the instrument Entry of the trocar into the pleural cavity is readily recognized The trocar is advanced sufficiently to insure that the shaft of the instrument and not merely the point of the stylet is inside the pleura The stylet is now fully withdrawn and the catheter is passed into the pleura through the side arm, whereupon the trocar is removed as the catheter is fed into it When the trocar shaft emerges from the skin, a hemostat is clamped across the catheter flush with the skin

the manometer attached to a pneumothorax apparatus, the rubber tubing on the discharged vent of the stopcock being utilized for the connection The tubing on the stopcock is sterile, but its tip can be given to an attendant to connect to the rubber tubing that leads to the pneumothorax manometer, while the operator remains sterile The needle, syringe and three-way stopcock are assembled and the needle is inserted into the pleura If the needle and syringe are connected through the stopcock, entry of the needle into *the pleura will be indicated when air is pulled into the syringe* whose plunger has been kept under traction If the needle is connected through the stopcock to the side vent, and, therefore, to the manometer, entry of the needle into the pleura is heralded by the onset of fluctuations registered on the manometer If the former connection was in use, the lever of the stopcock should then be turned to connect needle and side vent, at which time manometric fluctuations will occur

For accuracy, the manometric readings should be taken during even and quiet breathing

Adjustments of intrapleural pressures by injection or removal of air can be accomplished by using the pneumothorax apparatus or by using the syringe at hand Since small amounts of air withdrawn or delivered often will suffice to bring about the proper level of intrapleural pressures, a 30-cc or even a 10-cc syringe is occasionally adequate This adjustment is made by switching the lever on the stopcock to connect needle and syringe for withdrawal of air, after which appropriate repositioning of the lever will again permit the taking of pleural pressure readings To inject air through the syringe, the syringe can be detached and filled with room air while the needle is connected to the manometer When the syringe is replaced on the stopcock, the lever is properly turned, and measured amounts of air can be injected from the syringe If large amounts of air are to be injected or withdrawn, this can best be accomplished by using the pneumothorax apparatus

An obvious precaution calls for complete familiarity with the use and manipulation of the pneumothorax apparatus at hand before initiating this operation

Insertion of an Intercostal Catheter

There are two methods in general use for placing a catheter within the pleural space for the purpose of removing air or, on occasion, fluid from this body cavity

The neatest method involves the use of a thoracotomy trocar The area through which the catheter will be inserted is selected by review of x-ray films, although in most instances the catheter is inserted into the second

clearly determined while testing the respective sizes of trocar and catheter as outlined above

The alternate method for placing a catheter within the pleural space is that of direct insertion of the catheter, a hemostat or other such instrument being utilized to guide it

In this method, preparation and anesthetization of the appropriate site are the same as employed in the previously described method The skin is opened with a small knife blade A medium- or large-sized hemostatic forceps is used to open the tissues by blunt dissection When the pleura is entered, the jaws of the forceps are spread and the catheter is fed into the pleura between the separated jaws for the appropriate distance The hemostat is then removed The catheter is connected to a water seal and secured to the chest wall as previously described

Pericardiocentesis

The initial steps in this procedure are the same as those employed for thoracentesis The same equipment is recommended. The patient should be placed in semi-Fowler's position The two accepted routes for aspirating the pericardial sac are illustrated in Figure 11 These are the anterior, or parasternal, and the substernal, the needle entering just to the left of the base of the xiphoid process When utilizing the anterior approach, the fourth or fifth intercostal space is selected By passing the needle close to the sternum, injury to the internal mammary artery is usually avoided

In either approach, the needle is advanced toward the pericardium, which is entered with but slightly increased resistance Impingement of the heart itself against the needle is recognized by the transmission of definite thrusts to the needle, under these circumstances the needle should be withdrawn If fluid is present, it should appear in the syringe prior to impingement of the needle against the myocardium Obviously, small or thin layers of fluid are difficult to aspirate

Instruments for Minor Surgical Procedures

A *thoracentesis tray* should hold the following items

	No
4- x 4 inch gauze sponges	6
6-inch cotton tipped applicators	4
10-cc syringe	1
30 cc syringe	1
Test tubes with rubbers stops	2
Medicine glasses	2
Small round metal basin	1
Three-way stopcock	1
Rubber tubing, 18 inches long, 1/4 x 1/32-inch	1

and the catheter is pulled completely through the trocar The catheter is then anchored to the skin either by suture or adhesive tape and the area is covered by a small secure dressing A water seal is connected to the catheter and the system can then be opened by removal of the hemostat Even though sucking of some air is not of serious consequence during the period of catheter insertion, this occurrence should be kept to a minimum

Certain precautions should be taken before the trocar is inserted The catheter to be inserted should be passed through the trocar side arm to

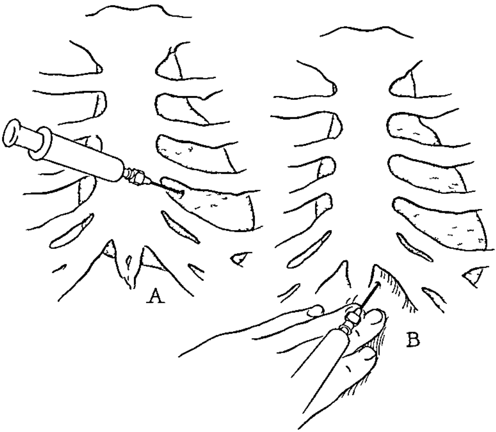

Fig 11 Parasternal and xiphosternal approach to pericardiocentesis

make sure that it will do so easily and especially that the funnel end of the catheter will not hang The trocar should be inspected to ascertain that it is of suitable size to accommodate at least a 14 F urethral catheter and still not of such caliber as to be bigger than the width of the intercostal space to be utilized An ordinary urethral catheter is best suited for this purpose Two or three additional fenestrations are made in the catheter an inch or so apart, increasing the available ostia for ingress of drainage into the system When this is done, the distance that the catheter must be fed beyond the trocar to insure that all fenestrations lie within the pleura should be

Chapter 8

LARYNGOLOGY AND BRONCHOESOPHAGOLOGY

PAUL H HOLINGER, M D, and KENNETH C JOHNSTON, M D

POSTOPERATIVE RESPIRATORY OBSTRUCTION EMERGENCIES

HEMORRHAGE, shock and respiratory obstruction constitute the most urgent of the emergencies in the postsurgical period The early recognition of these emergencies is best obtained where trained personnel can observe the patient in the recovery room until the immediate danger period has passed The recognition of respiratory obstruction and the maintenance of the pharyngeal airway by aspiration of pharyngeal secretions are, first, the duty of the recovery room attendants When the obstruction is possibly due to a laryngeal complication or to retained tracheal or bronchial secretions the further management of the problem should be the immediate responsibility of the anesthesiologist or the laryngologist It may be necessary to aspirate tracheal and bronchial secretions In some instances, especially in infants and children, special equipment and techniques are needed, or a tracheotomy may be necessary to bypass an edematous larynx or to maintain a clear airway

Postural Drainage and Pharyngeal Suction of Secretions

The most common aspect of respiratory obstruction is the accumulation of secretions in the pharynx, trachea and bronchi Patients who have depressed swallowing and cough reflexes must eliminate pharyngeal secretions Elimination may be aided by placing the patients in the lateral position so that the secretions will gravitate out of the mouth If feasible, placing the patient in the modified Trendelenburg position will aid the drainage In some patients, continuous hypopharyngeal suction or inter-

Needles	
25-gauge 5/8 inch	1
20 gauge 2-inch	1
18 gauge 2 1/2-inch	1
17-gauge 4-inch	1
5 1/2-inch straight Kelly forceps	1
Fan-folded towels	2
Minor drape sheet	1

A *pneumothorax set* consists of

	No
2 cc syringes	2
Needles	
25-gauge 5/8 inch	1
22 gauge 2-inch	1
19 gauge 2 inch, with short bevel	2
Three-way stopcock	1
Rubber tubing, 12 inches long, 1/4 x 1/32 inch	1
4- x 4 inch gauze dressings	6
3-inch cotton-tipped applicators	4
Minor drape sheet	1

A *chest trocar tray* should hold the following items

	No
Ochsner trocar #14	1
#3 Bard Parker knife handle with #11 knife blade	1
5-inch tissue forceps with teeth	1
5 1/2-inch curved Mayo scissors	1
5 1/2 straight Kelly forceps	1
6-inch curved Peon forceps	1
10 cc Luer-Lok syringe	1
2 cc syringe	1
12 F catheter	1
#14 F catheter	1
Rubber tubing, 45 inches long, 1/4 x 3/32-inch	1
Needles	
25-gauge 5/8 inch	1
20-gauge 2 inch	1
22 gauge 2 1/2-inch	1
Keith abdominal needle 3 inch	1
Surgeon's cutting needle, 1/2 circle	1
Black silk 2 0, 18 inches long	1
Medicine glass	1
4- x 4 inch gauze sponges	6
Fan-folded towels	2
Minor drape sheet	1
6 inch cotton tipped applicators	4

of gastric contents, which in itself can be an extremely dangerous occurrence during aspiration If vomiting and regurgitation are likely to occur, endotracheal tube aspiration is preferable to simple catheter aspiration

ENDOTRACHEAL TUBE ASPIRATION An anesthetic endotracheal tube aspiration can also be used for the removal of secretions A topical anesthetic agent is sprayed into the pharynx and the endotracheal tube is passed nasally by the blind technique or orally by direct laryngoscopy A well-lubricated no 16 F catheter is passed through the endotracheal tube and suction is accomplished In some instances, the endotracheal tube may be allowed to remain in place and the secretions aspirated intermittently with

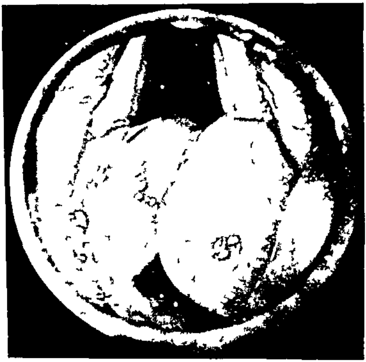

Fig 1 Laryngoscopical photograph showing post intratracheal tube granulomas on the vocal processes of the arytenoids

the suction catheter Patients have been reported in whom the endotracheal tube has remained in place for long periods of time, with little or no damage However, the frequency of observed and reported vocal cord injury, infection of the soft laryngeal tissues, chondritis of the arytenoid and cricoid cartilages, tracheitis, and pressure necrosis following this practice should contraindicate its use for periods of time longer than twelve to twenty-four hours The most serious of these complications consists of laryngeal edema with acute obstruction or the delayed appearance of granulomas of the arytenoids (Fig 1), in some subjects, laryngeal destruction has occurred with ultimate complete stenosis Because of these com-

mittent suction down to the larynx solves the problem. When the tongue is obstructing respiration, an oral or nasal airway must be inserted

Endotracheal Procedures

The endotracheal procedures need more skill than do those mentioned above, but should be learned and used by all medical personnel The presence of tracheal rales is not an inevitable last rite of the dying, unless neglected, but indicates that tracheal secretions are present and require aspiration The use of tracheobronchial toilet, which can be defined as artificial cleansing of the tracheobronchial tree, is a valuable and useful treatment that can be performed by several techniques

CATHETER ASPIRATION A catheter technique consists of placing the patient in a semi-Fowler position and introducing a no 16 F catheter through the nose, into the pharynx and into the trachea Visual control is possible through the use of a laryngeal mirror, the use of a coude catheter permits more accurate direction into the larynx, as rotation of the catheter points the angulated tip first through the glottis itself and then into the desired side of the thorax

A variation in this technique consists of direct laryngoscopic tracheal or bronchial aspiration This is especially effective in infants or children, or in the semicomatose adult patient who is unable to cough The larynx is exposed with the direct laryngoscope, and either a rubber catheter or a metal aspirator can be directed into the trachea In infants, the Sampson aspirator, consisting of a rubber-tipped metal tube with a thumb valve, is most effective A similar tube is available for this type of aspiration in adults A thumb valve in the aspirating system is extremely important in order to prevent a continuous suction during glottic closure The catheter or aspirating tubes should be sterile at the beginning of the procedure and subsequent contamination should be avoided as far as possible Aspiration should be as adequate as possible, but must be done quickly to avoid prolonged suction and respiratory distress After the aspirator is passed to the coryna it can be introduced blindly into either bronchus by rotating the head from side to side Adequate suction of 25 inches of water is essential

A tight binder, or manual pressure, over the site of incision assists in supporting the chest or abdominal wall during such aspiration procedures, reducing the likelihood of reopening of the wound and evisceration during violent coughing In addition, this step reduces the pain experienced during coughing in the immediate postoperative period

A catheter aspiration will in most instances be best accomplished if a light topical anesthetic spray of 2 per cent Pontocaine has been applied to the pharynx and larynx This will also reduce the possibility of regurgitation

to dry and thicken Maintenance of an adequate cough and liquefaction of secretions is of extreme importance For these reasons the use of narcotics must be kept at a satisfactory minimum, while at the same time the atmosphere, whether the patient is or is not in an oxygen tent in one of the hospital rooms or in a recovery room, must be properly humidified Aerosol inhalation will be beneficial, using antibiotic solutions when infection is liable to supervene, or wetting agents when liquefaction of secretions alone is desired However, in patients in whom formation of large amounts of mucus recurs rapidly, proper nasotracheobronchial toilet by the transnasal route can be maintained only when the house officer remains constantly with the patient Few hospitals are so fortunate as to have sufficient help available Therefore, the presence of audible rhonchi in the tracheobronchial tree, betokening voluminous mucus which the patient expectorates and which reforms rapidly after aspiration, usually indicates that a procedure permitting more frequent, direct tracheal aspiration is necessary In such patients a tracheotomy should be performed in order that the dyspnea and rapid respiration rate may be relieved by frequent, direct tracheal aspiration A tracheotomy allows a nurse to achieve this effect

Careful attention to the patient's early symptoms should allow the establishment of the tracheotomy early enough to prevent serious pulmonary infection and yet give the opportunity of avoiding a tracheotomy when it is possible to maintain proper tracheobronchial toilet without it A tracheotomy is indicated when the alternative measures, even though frequently repeated, have failed to give adequate or lasting relief, or when the signs and symptoms of hypoxemia have remained or become severe In addition, some operations, such as extensive esophageal or neck surgery and some neurosurgical procedures, and traumatic conditions, such as skull fracture, chest and maxillofacial injuries, may warrant a tracheotomy when it is necessary to short circuit the air past the mouth, pharynx, or larynx directly into the tracheobronchial tree The indications for tracheotomy in these conditions are to establish an airway as well as to permit direct repeated catheter suction

The time to do a tracheotomy is when contemplating it The number of tracheotomies performed too late far outweigh those done unnecessarily The most opportune time to do a tracheotomy is at the completion of the surgical procedure itself, while the intratracheal anesthesia tube is still in place The patient should not be allowed to exhaust himself in the struggle for oxygen when a tracheotomy could prevent this difficulty

As a tracheotomy has some disadvantages, it should not be done without adequate reason Following it, the physiology of the pulmonary tree becomes altered Secretions may be dehydrated and the inhaled air is not

plications, when a tube is likely to be needed for longer than twenty-four hours, a tracheotomy should be performed

Bronchoscopic Aspiration

Direct visualization of the tracheobronchial tree with a bronchoscope affords the most reliable and efficient method for removal of secretions or obstructing foreign bodies in this area, it also has diagnostic potentiality Bronchoscopic aspiration is indispensable in removing solid or thick semi-solid material that may be aspirated by a vomiting patient Aspiration of vomitus or other material occurs most frequently during "deliveries" or during emergency types of surgery which may have had to be performed shortly after the patient has eaten, or it may occur in patients with intestinal obstruction Battery-handle bronchoscopes as well as battery-handle

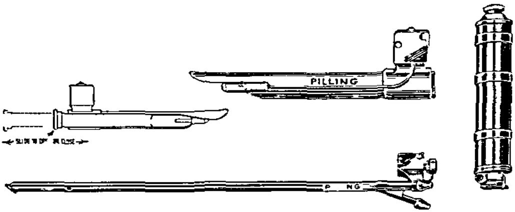

Fig 2 Battery handle bronchoscope and laryngoscopes

laryngoscopes are available to the anesthesiologist or laryngologist for the management of this problem during operation or in the immediate post-operative period (Fig 2) These scopes should be available for emergency use in the delivery room, the operating room suite and the recovery room A large alligator-type of forceps should be kept with the bronchoscope, this forceps should not be used for delicate foreign body removal, but to grasp large pieces of food that might obstruct the airway during or after administration of an anesthetic

Tracheotomy

If active cough or tracheal aspiration will completely relieve the symptoms caused by excessive mucus and will prevent their recurrence, then no further steps need be taken aside from continuation of these routines Oversedation in the immediate postoperative period tends to decrease the cough reflex and also causes the secretions in the tracheobronchial tree

The skin incision is sutured loosely The edges near the tube are left open to permit drainage and to eliminate the complication of subcutaneous emphysema which occurs if the skin edges are approximated up to the tube

EXTUBATION Extubation is most effectively carried out by using smaller and smaller tubes, and finally corking a small tube, or using a special decannulation stopper for a test period Smaller tubes allow a more gradual resumption of laryngeal breathing, while at the same time they reduce the intratracheal obstruction due to the tube itself Final removal of the tube is done only after a twenty-four-hour test period, with the tube plugged completely, has proved that the laryngeal airway is satisfactory

POSTOPERATIVE LARYNGEAL COMPLICATIONS

Laryngeal Edema

Postsurgical laryngeal edema may result in obstruction sufficient to necessitate a tracheotomy A traumatic intratracheal intubation, particularly in a small child or an infant, or a prolonged intratracheal anesthesia employed in operations about the neck may be responsible for the obstruction Laryngeal edema following burns or blast injuries may be increased during the intratracheal anesthesia induced to perform the surgery necessitated by the injury Thus, in the postoperative management of burns, tracheotomy is often indispensable, it facilitates aspiration of the pulmonary edema fluid and establishes an airway below the obstructed, edematous larynx, the tissues of which have been subjected to flash burns or injured by hot gases

While tracheotomy for inflammatory laryngeal lesions in infants is decreasing, owing to the use of antibiotics, the number of tracheotomies in infants under one month of age is increasing because of the surgery being performed for extensive congenital anomalies that were formerly considered hopeless These anomalies are generally gross ones of organs other than those of the respiratory tract, but the extensive surgery required for their correction has necessitated the prolonged use of an intratracheal tube A tracheotomy may be performed on the completion of such a surgical procedure, not only to insure an adequate airway, but also to permit frequent aspiration of secretions

A most critical time for infants is after tracheotomy It is during this period that constant observation, care and judgment are necessary Tracheotomized infants should be placed in a room with high humidity, and oxygen may be administered when necessary Recovery room care or twenty-four-hour special nursing attention with an experienced tracheotomy nurse is required Extreme care is exercised during and immediately

properly filtered, warmed or moistened There is a tendency for the patient to experience some increased difficulty in raising secretions from the tracheobronchial tree because the cough blast reflex is not assisted by glottic closure Following a tracheotomy, a nurse must be in constant attendance to remove the secretions with a suction catheter It must be remembered that the tracheotomized patient, particularly an infant or a child, cannot call for help should the tube become partially obstructed

TRACHEOTOMY TECHNIQUE In an extreme emergency, the simplest means of opening the airway is to palpate and incise the cricothyroid membrane lying between the rigid cricoid ring and the inferior border of the thyroid cartilage In this operation, the knife blade is plunged through the skin at right angles to the trachea and the knife twisted to separate the thyroid and cricoid cartilage to open the air passage This procedure, while lifesaving in many instances, is to be avoided if possible because of the danger of destroying the all important cricoid cartilage either at the time of the operation or through infection later If the cricothyroidotomy just described is performed, a low tracheotomy should be substituted as soon thereafter as the patient's condition permits, to reduce as much as possible the danger of cricoid infection

The conventional tracheotomy is performed through a midline incision in the center of Jackson's tracheotomy triangle This triangle has as its base the cricoid cartilage, its apex the suprasternal notch and as its lateral borders, the sternomastoid muscles Local anesthesia is employed unless the patient is in extremis or is comatose, or unless the airway is already established and general anesthetic is being administered, as would be the case if the tracheotomy were being performed at the completion of an operative procedure To transpose an emergency operation to a tranquil procedure, an airway may be established by inserting an intratracheal tube or a bronchoscope through the obstructed pharynx or larynx This eliminates the hazard of airway obstruction during the dissection and is of particular value in tracheotomies in infants and children, as well as in adults for whom the tracheotomy is being performed because of a tumor of the neck General anesthesia may be employed only if an airway has first been established through the obstruction A collar incision is an alternate incision which is considered by some to leave a less obvious scar With either incision, the dissection is carried downward to the midline through the fascial planes to expose the thyroid isthmus The trachea may be exposed above the isthmus or below it, or the isthmus may be ligated and cut and the trachea exposed under it A tracheal hook is used to grasp the trachea, and the second to fourth rings are incised The edges of the incised tracheal cartilages are separated with a Trousseau dilator, retractors, or a hemostat, and the proper tube is inserted

The first symptoms of postoperative massive atelectasis usually occur within twenty-four hours after the operation, but may begin as late as seventy-two hours postoperatively They consist of chest pain and a persistent, somewhat productive cough which the patient attempts to suppress because of pain both at the site of incision and in the chest Respiration becomes shallower and more rapid, soon being definitely labored This state may progress to cyanosis There is a correspondingly rapid rise in the temperature, but the pulse rate may not increase proportionately The sputum at the onset is usually scanty, it is thick, tenacious, glossy or white Later it becomes purulent

The essential physical findings are the shift of the heart and mediastinum to the affected side, dullness, limitation of motion, and elevation of the diaphragm Breath sounds change rapidly, depending on the amount of obstruction and whether or not a coughing spell dislodges secretions, they may be entirely absent

The use of a tight abdominal binder, especially in a patient who has had an upper abdominal operation, further limits the respiratory excursions and increases the incidence of collapse However, a tight binder employed temporarily may be of great help in splinting the patient while encouraging him to cough and dislodge secretions Anesthetic nerve block may be of aid in reducing pain and allowing more effective coughing The use of narcotics and atropine should be limited as much as possible

Bronchoscopic aspiration of the obstructing secretions, when other methods fail, should be employed without hesitation On introduction of the bronchoscope through the larynx, one is impressed by the amount of secretion lying in the trachea and both bronchi Because of its viscosity the secretion is aspirated with difficulty, but, by using an aspirating bronchoscope and an independent aspirator, more secretion can be removed in a minute or two than the patient can cough up in several days The secretion, if the aspiration is done shortly after the onset of the collapse, is white, very thick, viscid and tenacious, and it usually clots in the collecting tube It contains a great deal of fibrin, but very little pus and few bacteria, and because it is an excellent culture medium it soon becomes purulent and foul-smelling if allowed to stagnate in the trachea and bronchi

The change in the general condition of a patient following bronchoscopic aspiration is often as striking as that seen following a tracheotomy done because of acute laryngeal obstruction The immediate relief is reflected in the temperature, pulse and respiration curves Physical findings and roentgen-ray films show a rapid return to normal, although the cough continues to be productive for a few days Should there be a tendency toward replugging, however, one need not hesitate to do repeated bronchoscopic aspirations

after feedings, including frequent suction with or without saline irrigation of the trachea Cleansing of the tube as often as it becomes even slightly filled with secretion, and close observation of the breathing and the patient's color are essential Frequent changes of the patient's position are helpful, although most tracheotomized infants prefer some particular position in which respiration seems to be most comfortable

Laryngeal Paralysis

Laryngeal complications of thyroidectomy are significant and constitute an important aspect of postoperative care Paralysis occurring as a result of unilateral or bilateral recurrent laryngeal nerve section causes varying degrees of respiratory obstruction Such paralysis results in a midline position of the cord and some loss of tension In unilateral paralysis the voice is whispered or husky, and obstruction may or may not be a factor, depending on the degree of associated spasm In bilateral paralysis, however, the voice may be clear, but respiratory obstruction becomes acute, especially on effort, the condition simulates laryngeal spasm because the cords do not abduct Mirror or direct examination of the larynx shows the failure of abduction, but often such examination is extremely difficult because of the severe stridor and dyspnea being experienced by the patient Under these circumstances, the diagnosis must be surmised and a tracheotomy performed at once A similar situation may accompany neurosurgical procedures involving the base of the brain In these, central bilateral tenth nerve paralysis necessitates a tracheotomy to maintain the airway

POSTOPERATIVE PULMONARY COMPLICATIONS

Atelectasis

Postoperative massive collapse of the lung is the massive atelectasis due to the obstruction of one of the main bronchi or several secondary bronchi on the same side by thick, viscid, mucofibrinous secretions, and may follow any surgical procedure Important etiological factors are those which tend toward an increase in the production of mucoid secretion by the tracheobronchial mucosa, associated with those conditions which aid in the stagnation of these secretions by retarding the cough reflex and expansion of the chest Thus, upper abdominal operations associated with distention, tight binders, and chest operations preceded and followed by excessive sedation with atropine, morphine and similar drugs are most likely to be followed by massive atelectasis Other possible factors are preoperative bronchitis, generally poor muscular tone in older individuals, and associated conditions such as acute anterior poliomyelitis or other neurogenic lesions that have caused diaphragmatic or intercostal muscular weakness

Fig 4 Removable single tooth bridge swallowed by patient under general anesthesia

airway permit introduction of a large-sized esophagoscope to free mucosal folds from the object

CARE FOLLOWING LARYNGOSCOPY, BRONCHOSCOPY AND ESOPHAGOSCOPY

Laryngoscopy, bronchoscopy and esophagoscopy are diagnostic and therapeutic procedures which require pre- and postoperative routines to provide adequate patient care and comfort In addition, these routines should be designed to prevent complications, or the recognition of them if they do occur Preoperatively it is assumed that thorough physical and roentgen-ray studies have been made to reveal or disprove the presence of such contraindications to the procedures as cardiac decompensating aortic aneurism and acute respiratory infection The patient should not have eaten for at least four hours prior to the examination, and in those with

Foreign Bodies in the Air or Food Passages

Fortunately, this postoperative complication is relatively rare The foreign body usually consists of a tooth, a bridge or even a whole denture that was not removed prior to anesthesia, or to parts of teeth, bridge work or instruments that were broken and aspirated during some oral surgical procedure When such an accident is suspected or known to have occurred, an immediate x-ray study is indicated The most frequent accidents of this type involve the deciduous incisor or canine teeth of children dislodged

Fig 3 Deciduous tooth in right lower lobe bronchus aspirated during tonsillectomy

during a tonsillectomy (Fig 3), and the removable single-tooth bridge in adults (Fig 4) Attempts at endoscopic removal should be made only after the patient's condition is stabilized following his original operation, and only with adequate preparation of instruments and endoscopic plan To hurriedly bronchoscope the patient for removal of a known or suspected foreign body of this type, without adequate localization and without adequate instrument preparation, will only result in failure, usually driving the foreign body even deeper into the tracheobronchial tree

Dentures may be forced deep in the hypopharynx or cervical esophagus when inadvertently left in the mouth during induction of anesthesia The patient experiences pain and difficulty in swallowing on awakening Removal is usually possible perorally, a general anesthetic and intratracheal

Adults

Preoperative sedation for peroral endoscopy in adults generally is obtained by giving morphine or Demerol, unless the patient is seriously debilitated or has respiratory obstruction Atropine is used preoperatively for laryngoscopy and esophagoscopy to reduce secretions, but may be dispensed with prior to a bronchoscopic examination if the procedure is being performed to determine the amount or source of secretions, or if the secretions are to be collected for pathological bacteriological investigations When a topical local anesthetic is to be used, a barbiturate is administered preoperatively Allonal or a similar anti-nauseant is effective as well

Following any peroral endoscopic procedures in adults, performed with the patient under local anesthesia, routinely food and fluids are withheld for two hours, following which time liquids may be given Later, soft foods and, finally, a general diet may be given the next day unless the patient had some condition such as an esophageal stenosis that could contraindicate solid foods

Phenobarbital sodium may be administered intramuscularly if signs of hyperactivity or unusual talkativeness are noted Since these reactions may, on rare occasions, progress rapidly as the result of the toxicity of the topical anesthetic, an intratracheal tube, laryngoscope, oxygen and a breathing bag should be on hand for use in the control of more severe cocaine or pontocaine reaction However, these reactions usually occur just before, during or immediately after the operative procedure and not after the patient has returned to the recovery room Therefore, all material including syringe, needle, alcohol sponge, sterile water, Pentothal Sodium and a file to open the vial should be available in the operating room to permit the management of the more severe, convulsive reaction When severe reaction takes place, the immediate intravenous administration of the barbiturate with the simultaneous establishment of the airway with the intratracheal tube is lifesaving

When esophageal perforation is suspected, all food and fluids are withheld and x-ray examination of the neck and chest is ordered Antibiotics should be administered and intravenous fluids are indicated This therapy should be continued until all evidence of perforation and infection has subsided Small perforation can sometimes be successfully managed conservatively with early treatment Signs of persistent leakage, progressive infection and abscess formation are indications for surgical intervention

known or suspected severe cardiospasm the esophagus should be lavaged in order to prevent regurgitation and overflow of food into the tracheobronchial tree during the introduction of the esophagoscope Preoperative sedation is of great importance, but is contraindicated in patients with respiratory obstruction, older, debilitated individuals and small infants For others the use of the appropriate age-dosage of morphine or Demerol is indicated Barbiturates are given preoperatively if a topical anesthetic is to be used, but as pre-endoscopic analgesics in children they are definitely inferior to morphine in effectiveness The child sedated with a barbiturate may come to the operating room apparently fast asleep, only to awaken and be entirely uncontrollable as the procedure is begun, a child properly sedated with morphine (provided there is no respiratory obstruction) is more relaxed not only before but during the endoscopy

Infants and Children

Since most peroral endoscopic examinations in infants and children are performed without anesthesia, the problems of postoperative management are related entirely to the basic pathological process for which the procedure was performed and the degree of reaction to the instrumentation that might be anticipated Generally the infant may be allowed to resume his preoperative diet within one-half hour after returning to the ward In infants and children, careful laryngoscopic or bronchoscopic procedures, using small instruments inserted with caution, need not produce postoperative complications Of greatest importance is that the procedure is not immediately repeated, when repetition is necessary, this should not be undertaken until all evidence of reaction from the previous procedure has disappeared Should laryngeal obstruction appear following a traumatic procedure, an atmosphere of high humidity is of great assistance in its relief The child should be kept as quiet as possible, fluids should be forced, and humidified oxygen should be administered if necessary A complete tracheotomy set should be available, since, when oxygen is administered, the last procedure short of a tracheotomy has been employed Unquestionably, the most important points in avoiding post-bronchoscopy laryngeal obstruction are limitation of the duration of the procedure and the use of small instruments

For endoscopic procedures performed with the patient under general anesthesia, particular attention must be paid to the maintenance of the airway, *since the local laryngeal stimulation that accompanies either* laryngoscopy, bronchoscopy or esophagoscopy may be sufficient to cause rather prolonged or recurring laryngeal spasm

nausea, which should be avoided at all costs Tube feedings may be started the first postoperative day Medications, such as potassium iodide and ammonium chloride, may be used if necessary to liquify secretions

Care of the tracheotomy tube constitutes the most important part of the postlaryngectomy care The tracheotomy tube should be aspirated as often as secretions are present If the tube is dry, 10 drops of half normal saline should be instilled into it at hourly intervals and then reaspirated to remove any crusts that might form Occasionally, these crusts become so large that they obstruct the entire tube and cannot be removed through the tube. Under these circumstances the tube must be removed and the obstructing material expelled by a strong cough or, if adherent to the tracheal walls, removed by a hemostat or bronchoscopic forceps Auscultation of the chest at frequent intervals detects obstruction in the lobar or segmental bronchi, when obstruction is found it may be relieved by directing the aspirating catheter into the affected bronchus by tilting the tracheotomy tube

Aside from the special problems of tracheotomy care, routine postoperative observations of temperature (rectal), blood pressure, evidence of bleeding, urinary output and peripheral circulation are indicated The patient should be encouraged to expectorate his saliva rather than attempt to swallow it Analgesics, such as 25 to 50 mg of Demerol, may be given every three to four hours Constipation is often an annoying complication, since the role of the larynx in the regulation of the chest and abdominal pressure is absent in the laryngectomized patient An ounce of mineral oil may be given through the nasogastric tube on the second, third and fourth day postoperatively to reduce this problem The patient should be provided with pencil and paper, or a "magic slate" may be used to advantage

Usually the nasogastric tube may be removed on the fifth to the tenth postoperative day, after close observation of the tracheotomy opening has demonstrated that there is no fistula from the pharynx If there is any doubt, a test for fistula is made by giving the patient a sip of a colored fluid by mouth After removal of the tube, liquid feedings are continued for three or four days and then a soft and, finally, a general diet is given Buccoesophageal speech lessons may generally be started before the patient leaves the hospital, provided the wound is well healed

As soon as he is able, the patient should be taught to clean and care for his own tracheotomy tube He may be taught to change it himself before leaving the hospital, standing before a mirror to insure proper insertion of the tube to avoid making a false passage A water-soluble lubricant, rather than mineral oil or petrolatum, should be used to avoid the passage of nonsoluble oils into the bronchopulmonary system When the tracheostomy wound is completely healed, the tracheotomy tube itself may often be left

POST-LARYNGECTOMY CARE

The post-laryngectomized patient has serious psychological problems as well as physical problems Preoperatively he has been told of the seriousness of his condition which has necessitated the removal of the larynx and has been told of his tracheotomy However, his frustration at being unable to talk upon awakening is difficult for him to accept In right-handed individuals, fluids should be administered into the left arm to leave the right arm free for writing The patient's wants should be anticipated because of his inability to ask for the things he needs Antibiotic therapy is instituted prior to surgery and continued immediately after it Mouth hygiene, both pre- and postoperatively, is important to reduce local infection Perborate mouthwash is most effective Typed and crossmatched blood should be available 1000 cc , if the procedure is limited to a laryngectomy, 2000 cc , if a radical neck dissection is also to be performed The preoperative orders should include the amount and type of sedative desired, sedation being minimal or eliminated if the patient has severe respiratory obstruction or is an old or debilitated individual A preoperative enema is of value The operative field should be prepared by shaving the neck and chest to the nipple line, and well posterior to the ear, if a radical neck dissection is to accompany the laryngectomy Arrangements for the postoperative care of the tracheotomy opening should be included in the preoperative preparations The tracheotomy bedside set-up should include the aspirator, humidifier, oxygen, a duplicate of the tube the patient will be wearing and the materials for cleaning the inner tube

Postoperatively the head of the bed may be slightly elevated for comfort and efficiency of the respiratory system *The head should be slightly flexed onto the neck in order to avoid tension on the pharynx sutures*

Ambulation should be started as soon as the patient's condition permits, usually on the first or second postoperative day Immediately postoperatively, the pulse rate and blood pressure should be determined every half hour until they are stable Oxygen may be administered if needed and should be given through an oxygen-tracheotomy adaptor, thoroughly humidified and at a flow of 6 to 8 liters per minute, it can be given through a funnel placed over the tracheotomy opening if the adaptor is not available Oxygen given by catheter directly into the tracheotomy tube is irritating to the respiratory mucosa Aerosols may be used if infection or dryness of secretions becomes severe Postoperative fluids may be given intravenously for the first twenty-four hours, dependent upon the standard intake and output tables Thirty cc of water may be inserted through the nasogastric tube every two hours to insure its patency A larger quantity may cause

Chapter 9

SURGERY OF THE ABDOMEN

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In this chapter a description will be given of the routine postoperative care of patients undergoing abdominal surgery, as well as the details of care following specific types of abdominal surgery Although the scope of the chapter does not warrant a detailed account of preoperative care, this care is so inseparably linked with postoperative care that brief mention of it is indicated

PREOPERATIVE CARE

As in all types of surgery, the postoperative course of patients undergoing abdominal surgery is frequently made much less eventful by intelligent and foresighted preoperative care If the patient has been restored to as near normal as possible, nutrition-wise, preoperatively, he is much better able to tolerate the operative trauma, and postoperative complications will be reduced Probably one of the greatest advances in surgical therapy is the recognition of the importance of adequate preoperative preparation of patients undergoing extensive surgery

It will be recognized that intelligent postoperative care really begins before the patient is taken to the operating room Establishing adequate rapport with the patient preoperatively and discussing with him what will be expected of him postoperatively aid in no little measure to the ease of postoperative care The patient should be told preoperatively that he will be asked to cough and take deep breaths and that he must do this in spite of the discomfort which it may produce He must be assured that every effort will be made to reduce the postoperative discomfort to allow him to cooperate He should be advised that under ordinary circumstances he will be asked to move about in bed and that as early as the morning following his operation he will be up walking about

out, to be reintroduced only occasionally to insure the adequate size of the tracheostomy opening

Most distressing of the complications following laryngectomy is the development of a fistula between the pharynx and the skin, especially if this occurs at the mucocutaneous junction around the tracheostomy opening If a fistula does develop, it generally is manifest between the fifth and ninth postoperative day, and is due to improper pharyngeal closure, poor blood supply to the flaps, insufficient wound drainage, oral feedings begun too early, or residual tumor tissue Treatment consists in reintroduction of the feeding tube Closure generally takes place spontaneously, although larger fistulae may require secondary closure

What is the volume of output, through the kidneys, bowels, fistula, gastrointestinal decompression and vomiting?

What are the temperature and pulse and respiration rates?

While the respirations are being checked for frequency, note is made of any lag that may be present on one side or the other It is observed whether or not the trachea is deviated from its normal position The chest is percussed for dullness and auscultation is performed for detection of abnormal breath sounds or the absence of breath sounds The pulse is checked not only for rate, but also for character An irregularity may suggest that more extensive evaluation of the cardiac status be made

In all abdominal surgical patients the abdomen must be checked in a routine fashion for evidences of distention and unusual tenderness, and for bowel sounds The wound itself should not be exposed unless there is unusual pain, moist dressings, or an elevation in temperature It is common practice in some clinics to discard the dressings on the second or third postoperative day The author can see no particular advantage in this practice, except that the wound may be more easily observed

The costovertebral angles are checked for tenderness which might denote renal infection

The extremities must be carefully examined for evidence of thrombophlebitis or edema The calf, popliteal space and thigh should be quickly but carefully examined for tenderness Test should be made for Homans' sign

By the above-mentioned means the common areas of postoperative complication have been checked, i e , lungs, heart, wound, intra-abdomen, urinary tract, and limbs (for thrombophlebitis) Complications arising from these common areas give rise to increased temperature and pulse and respiratory rates

Detection of Common Causes of Fever

It will aid the house officer to know the particular complications which might be expected from an increase in temperature and pulse and respiration rates on any particular day postoperatively

When the temperature and the pulse and respiration rates rise simultaneously on the first and second postoperative day the probability is that the patient is suffering from a pulmonary complication This most commonly, of course, is atelectasis due to inadequate ventilation of the lungs and inadequate or improper coughing Atelectasis is aided, too, by immobility of the patient

Fever appearing on the third or fourth postoperative day without an increase in respiratory rate and with only a moderate rise in pulse rate

The surgeon and house staff officer on the surgical service must be aware of the complications which are common to all types of surgery and particularly of those complications common to the particular type of surgery being undertaken

Cardiac, pulmonary, urological and vascular (e g , thrombophlebitis) complications are common to all types of surgery A careful preoperative evaluation of the patient's cardiac status will be invaluable, particularly in aged patients, in estimating the amount of fluids, electrolytes and blood which the patient may be able to tolerate postoperatively Similarly, careful evaluation of upper urinary tract function may indicate the degree to which intravenous alimentation will be tolerated postoperatively Evaluation of the degree of any urinary bladder neck obstruction preoperatively may indicate in advance the necessity for catheter drainage postoperatively Examination of the lower extremities may reveal the presence of extensive varicose veins which suggests the increased possibility of stasis and thrombophlebitis in the postoperative period

GENERAL ROUTINE POSTOPERATIVE CARE

Check for Indications of Complications

Because of the press of time, a busy surgical resident, who must frequently complete his rounds before the daily operative schedule is begun, must develop a routine method of checking each postoperative patient rapidly but thoroughly He must ask each patient a set of unbiased questions designed to reveal the presence of any of the general complications which might occur In addition, there will be biased questions designed to reveal the presence of any deviations from the normal postoperative course in a patient having a particular operation The resident must train himself to observe the patient routinely in such a fashion that no points will be overlooked The following are a group of routine questions which should be asked concerning the patient and answered by him and/or his attending nurse

Is coughing sufficient to remove any accumulated secretions in the lungs?

Is the patient taking deep breaths?

Is the patient moving about and changing position from time to time?

Are adequate amounts of fluids being received orally and/or intravenously?

How much, if any, type of pain has occurred?

Has flatus or a stool been passed?

Are adequate amounts of urine being passed?

wound from gross external contamination It should not be completely sealed with adhesive tape Only enough tape should be used to secure it adequately Large amounts of tape make the patient very uncomfortable while they are in place and are even more distressing when they are removed All dressings of surgical wounds must be done with sterile technique The outer dressings only should be removed with the hand The deeper dressings next to the wound should be removed with sterile instruments The area immediately adjacent to the wound may be cleansed with an aqueous solution of Zepherin After seven days, when the sutures are to be removed, only a very light dressing, if indeed any at all, should be placed over the wound Even this dressing may be removed within twenty-four to forty-eight hours if there is good healing of the skin edges

When removing sutures, each suture should be cut close to the skin and the free end withdrawn across the wound so that there is no tendency to separate the edges of the wound The sutures should be cut in such a fashion that as little as possible of the unburied portions is withdrawn beneath the skin

When a wound is inspected for evidence of infection, it is frequently necessary to palpate the area adjacent to the wound gently in order to detect areas of tenderness Such palpation should be done either with a sterile gloved hand or through a towel Frequently a subcutaneous abscess will be located by palpation which is not as yet evident by simple inspection This is particularly true when wound infection develops while the patient is receiving antibiotic therapy When a wound infection is discovered, enough of the cutaneous sutures must be removed to allow adequate drainage The ease with which drainage may be accomplished when interrupted skin sutures have been used is one of the advantages of this type of suture It is important, when a wound abscess is drained, to obtain a culture of the evacuated material so that specific antibiotic therapy may be ordered

When clips have been used to close the skin, these are removed by a clip remover Care should be exercised not to separate the wound edges forcefully as the clips are removed

The care of colostomy wounds differs This will be described under Colostomy

Drains

Drains which have been placed within the abdominal cavity are ordinarily gradually shortened 1 or 2 inches each day, until they are completely removed The amount of daily shortening is, of course, dependent upon the length of the drain and the purpose for which the drain was placed Drains are ordinarily removed by the fourth or fifth day and are rarely maintained in place longer than seven or eight days

suggests the onset of infection other than pulmonary The wound must then be carefully inspected for evidences of infection The urine must be checked for signs of pyelonephritis

Fever occurring after the sixth or seventh day postoperatively, with a rather sharp increase in pulse rate which may be out of proportion to het fever, suggests the possibility of thrombophlebitis

If the fever suggestive of infection has persisted and no external evidence of wound infection is found, examinations must be carried out to detect the presence of intra-abdominal abscess formation Common areas of infection are the rectum and the subdiaphragm A simple rectal examination will frequently reveal the presence of a rectal abscess, whereas a chest x-ray film and fluoroscopy of the diaphragms will demonstrate the development of a subdiaphragmatic abscess

The changes in the vital signs which are associated with particular operations will be discussed under each of the operations in turn

Routine Orders

After a careful examination and questioning of the patient and/or attendant have been carried out, the orders must be written So that important points are not omitted, it is well for the house officer to establish a routine format of orders The orders should include the following

1 Comfort of the patient—medication for the relief of pain, if present, hypnotic for sleep in the evening, if needed

2 Nutrition of the patient—the amount and type of oral feedings, if any, the amount and type of intravenous alimentation

3 The position of the patient—ambulation or bed rest, particular movements or positions to be avoided

4 Medications—antibiotics, vitamins, cardiac drugs, etc

5 Special procedures—for decompression, catheterization, oxygen therapy, dressing change, etc

6 Laboratory tests—x-ray examination, blood chemistry studies, blood counts, urinalysis, etc Although it is true that in some hospitals the orders for laboratory work are not placed on the doctors' order sheets, it may be found convenient to place them there so that the nurses can better plan their work for the day with the patient

Wound Care

The ordinary, cleanly incised, surgical wound need not be dressed, after the initial application of the dressing, for seven or eight days, unless this is indicated by the presence of infection The initial dressing should not be uncomfortably bulky, it needs to be only sufficient to protect the

The tube should be passed through one of the nares When it is to be used for decompression, the largest size tube which will most readily pass should be used, since this will reduce the possibility of clogging of the tube Ready passage is sometimes accomplished by allowing the patient to swallow small sips of water as the tube is advanced through the nose

After the tube is judged to have reached the stomach, one must check to make certain that it is not in the tracheobronchial tree If a small amount of air is injected through the tube with a syringe while one listens with a stethoscope over the stomach, artificially produced borborygmus will be heard when the tube is properly placed The secretions of the stomach should be acid and the position of the tube may be checked by ascertaining the *pH* of the material aspirated When a tube has inadvertently entered the trachea, coughing is usually violent However, some patients with poor reflexes can tolerate tracheal intubation without response Therefore, it is always necessary to check the position of the tube

When the tube is finally in place it should be secured to the face with tape, but in such a way that there is no pressure against the ala nasi Any pressure in this area becomes very uncomfortable to the patient and may in a short time produce a very painful ulcer The tube should not obstruct the patient's visual field The proximal end of the tube is attached to a suction apparatus It is preferable to have a transparent adapter between the Levin tube and the tube leading to the suction apparatus, so that the material being aspirated from the stomach can be readily visualized

A careful record should be kept of the amount and character of aspirated material from all tubes

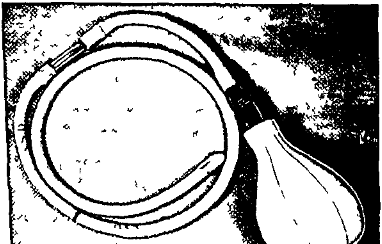

Fig 2 Gastric lavage tube

Laboratory Tests

Although laboratory tests are of inestimable value in the postoperative care of patients, they are too often used as a substitute for adequate examination of the patient Frequently, extensive blood electrolyte tests are ordered for a patient who is afebrile and whose intake and output are adequate It must be remembered that laboratory tests are expensive to the hospital and to the patient, and that they must be ordered only after questioning and examination of the patient

GASTROINTESTINAL INTUBATION

Gastrointestinal intubation is one of the commonest procedures used on a surgical service Familiarity with the various tubes available and of the particular application of each type of tube is essential to every house officer In general, decompression of the gastrointestinal tract by means of a tube is indicated whenever an obstruction of the gastrointestinal tract is present Gastrointestinal intubation is indicated when a surgeon wishes to place the gastrointestinal tract at rest following an operation Another use for gastrointestinal intubation is that of a means of feeding the patient who refuses to eat, or has little or no appetite The indications for and the application of several of the more common tubes will be described

Levin Tube (*Fig 1*)

The simplest tube and the one which finds the most general use is the Levin tube, a single-lumen rubber or plastic tube with several outlets at its distal end It is available in several small-caliber sizes

The Levin tube should be cooled in ice in order to make it less flexible and more easily inserted It should be well lubricated, preferably with mineral oil, since many of the other lubricants tend to crust in the nose

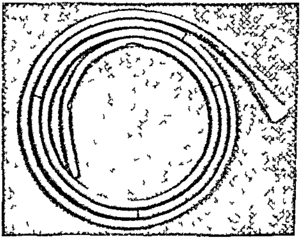

Fig 1 Levin tube

peristaltic activity is present, it is usually unnecessary to advance the tube, since the mercury will be pulled along by the activity

Any tube which is long enough to traverse the entire gastrointestinal tract, such as the Harris tube, should not be removed if there is suspicion that it has passed the ileocecal valve Forceful traction at the proximal end when the tube has passed the ileocecal valve may tear the ileum at its point of juncture with the cecum Under such circumstances it is much safer to cut the tube off at the nose and allow it to complete its journey through the gastrointestinal tract, removing it as it presents at the anus Even though a long tube has not reached the ileocecal valve, its removal must be done slowly to allow the bowel to unsleeve itself from the tube The tube should be withdrawn for 6 or 8 inches, then, after several minutes have been allowed to elapse, it should be withdrawn another few inches This process is repeated until the end of the tube is judged to be in the stomach, after which it may be withdrawn rather quickly

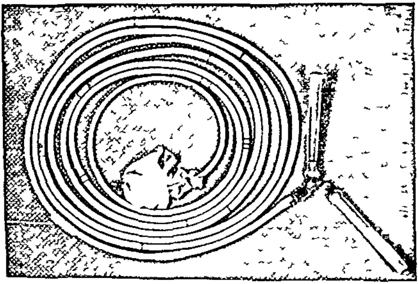

Fig 4 Miller-Abbott tube

Miller-Abbott Tube (Fig 4)

The Miller-Abbott tube is a long double-lumen tube for intubation of the small bowel One lumen of the tube has its outlet at the tip of the tube and proximal to a small rubber bag which is near the end of the tube The second lumen ends within the small rubber bag

The well-lubricated tube is passed through the nose into the pharynx, and the patient swallows the tube After the tube is in the stomach, mercury or air may be used to inflate the balloon in the stomach The balloon then

Gastric Lavage Tube (Ewald) (Fig 2)

This tube is a large-bore single-lumen tube, usually no 40 to 45 F, which is passed through the mouth and into the stomach for the purposes of aspirating large amounts of gastric residue or washing poisons or other substances from the stomach Such a tube should be used to empty barium from the obstructed stomach when this substance has been used in the x-ray examination Retention of such material for any length of time will result in a very viscid gastric content which cannot be evacuated readily

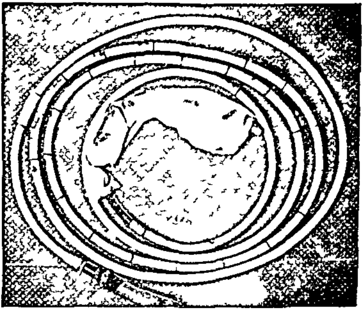

Fig 3 Harris tube

Harris Tube (Fig 3)

The Harris tube is a long, small-caliber, single-lumen tube for passage into the small bowel Near its distal end, which is open, is a small rubber bag Proximal to the bag are several small holes The bag is filled with mercury and secured in place with a black silk ligature All air must be evacuated from the bag before it is secured

When the tube and rubber bag filled with mercury are well lubricated they may be readily passed through the nostril because of the mobility of the mercury The weight of the mercury makes passage into the stomach very easy if the patient is in a sitting or semi-reclining position When peristaltic activity is present in the gastrointestinal tract, the mercury, acting as a bolus, will on most occasions readily carry the tube into the duodenum if the patient is placed in a right Sims' position The tube should not be secured at the nose, but should be allowed to pass at will When

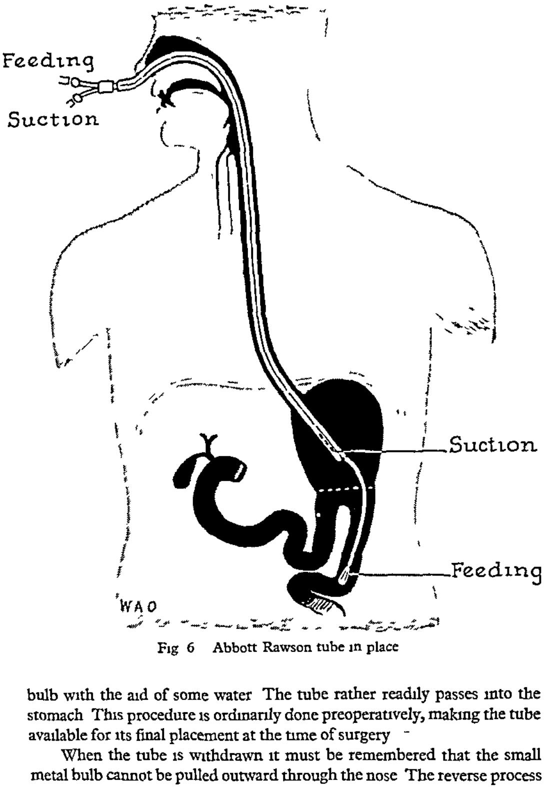

Fig 6 Abbott Rawson tube in place

bulb with the aid of some water The tube rather readily passes into the stomach This procedure is ordinarily done preoperatively, making the tube available for its final placement at the time of surgery

When the tube is withdrawn it must be remembered that the small metal bulb cannot be pulled outward through the nose The reverse process used during intubation is used for withdrawal When the metal bulb appears in the pharynx it is withdrawn out through the mouth, removed, and then the tube is withdrawn through the nose

acts as a bolus and will be carried downward by peristalsis, when this is present

The author believes that the Miller-Abbott tube has little advantage, if any, over the Harris tube, and has the disadvantage of having a very tiny lumen for aspiration which readily becomes plugged In his experience, no long tube can be readily passed into the small bowel if some peristaltic activity is not present He believes that the only purpose served by prolonged attempts at passage of a tube through the pylorus under x-ray control, when severe paralytic ileus is present, is that of tiring the patient needlessly

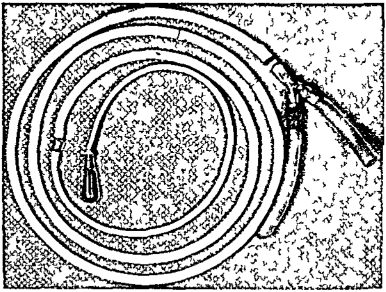

Fig 5 Abbott-Rawson tube

Abbott-Rawson Tube (Figs 5 and 6)

The Abbott-Rawson tube is a double-lumen tube the terminal end of which is attached to a small metal bulb About 6 to 8 inches proximal to the end, the first lumen terminates in several small holes This tube is used in gastric surgery in such a manner that the end of the tube may be placed distal to the gastroenterostomy stoma, while the proximal lumen is above the gastroenterostomy stoma

Because of the metal bulb on the end of the tube, a slightly different technique is necessary in the passage of this tube than that employed when other types of tubes are used The tip of the tube without the bulb attached is passed through the nares into the pharynx It is then grasped with a hemostatic forcep and withdrawn out through the mouth The small metal bulb is then attached, and the tube is withdrawn back through the nose so that the bulb is in the pharynx The patient then swallows the small metal

patient bears very careful observation Constant attention must be given to the suction tube to maintain its patency, since blood clots will frequently plug it

When shock develops in the postoperative period, hidden bleeding must always be suspected Most often the diagnosis will be made only after frequent careful observations of the patient over a brief period

Whenever postoperative hemorrhage is suspected, blood should be crossmatched, even though subsequent observation of the patient makes blood transfusion unnecessary

Peritonitis and Localized Abscess

Postoperative peritonitis accounts for about one quarter of the deaths in the postoperative period The recognition of peritonitis in the postoperative period is sometimes difficult because the manifestations are apt to be insidious and much less pronounced than are those of the peritonitis produced by ruptured viscera or due to other causes The abdominal pain, tenderness and muscle spasm may be minimal This is particularly true in elderly patients However, vomiting and distention are quite constant findings Frequently, tachycardia, fever, distention, and occasional vomiting are the only demonstrable manifestations The diagnosis may be made without difficulty, especially when the possibility of other complications such as pneumonia and wound infection has been excluded Peritonitis following gastrointestinal surgery may, of course, develop at any time in the immediate postoperative period, depending upon the virulence of the organism, the resistance of the patient, and other factors Its most common cause is the continued contamination of the peritoneal cavity from a leak in a poorly constructed suture line. The generous use of antibiotics routinely in the postoperative period is not a substitute for good surgery No amount of antibiotics will prevent peritonitis when suture lines leak Because of the danger from contamination from suture lines, it is the practice of the author and his colleagues to place drains near all suture lines in the large bowel where the chance of contamination is greatest Should a leak occur when a drain is placed, there is a good possibility that the drainage will be led to the outside by the drain and the infection will remain localized

With the generous use of antibiotics, strains of very resistant bacteria have developed and are frequently found as part of the hospital population of bacteria These bacteria, frequently staphylococci, may become exceedingly virulent and may produce fulminating peritonitis The problem which presents itself, when a diagnosis of peritonitis has been made, is whether the peritonitis is due to continual leakage from the gastrointestinal tract or is due to contamination at the time of operation Ordinarily, operation to

Feeding Tube

There are many small-caliber no 10 to 12 F plastic tubes available for passage into the stomach for feeding purposes These tubes are ordinarily passed through the nose and are swallowed by the patient Because of their small caliber they are very readily tolerated The food which is passed through them must have a low viscosity in order that the ubes will not become plugged It is wise to wash them frequently with saline solution

GENERAL POSTOPERATIVE COMPLICATIONS

Postoperative complications following abdominal surgery may be divided into two general groups The first group of complications are those which are common to all types of abdominal surgery The second group of complications are those which occur following a particular operative procedure Hemorrhage, peritonitis and localized abscess, ileus, evisceration, wound infection, and shock will be discussed as the major complications of the first type The care of complications related to other systems such as atelectasis are discussed elsewhere

Hemorrhage

Postoperative hemorrhage has been the greatest fear of all surgeons since the beginning of surgery Fortunately, with the more careful operative technique that good anesthesia permits, individual ligation of blood vessels, better ligature materials, and the relative sterility of operative wounds, this complication is much less frequent than in the earlier days of surgery However, it is a complication which must be kept constantly in mind because its early detection and vigorous therapy will usually prevent a fatality The most easily detectable type of hemorrhage, of course, is that which appears externally and is noted immediately as staining on the dressings by the attending nurses Immediate direct observation of the wound to determine the possible location of the bleeding should be made Frequently, a small arteriole in the skin edge can be the site of a rather extensive, although not fatal, amount of bleeding A mattress skin suture properly placed will readily control such hemorrhage When drains have been placed within the abdominal cavity and the hemorrhage appears to be from this source, careful observation of the patient's pulse and blood pressure must be made at frequent intervals to detect the extent of the intra-abdominal hemorrhage

Excessive bleeding may occur into the gastrointestinal tract following surgery on it Such bleeding most frequently takes place following gastric surgery and is detected by noting fresh blood in the aspirated material Although reoperation to control such bleeding is not often necessary, the

Evisceration

Evisceration though an abdominal wound is a dramatic experience for the surgeon and a terrifying one for the patient It is most apt to occur in malnourished patients, in obese patients, in those patients with a severe cough and in those who have developed marked ileus or ascites Special care should be taken in malnourished and obese patients during closure of the wound, to reduce the possibility of evisceration to a minimum

Probably the earliest finding indicating evisceration is that of serosanguinous drainage on the dressings The patient may state that he coughed or otherwise strained and "felt something give" and that after this he noticed that his abdomen was moist Inspection will reveal the serosanguinous drainage Such drainage is primo-facie evidence of impending wound evisceration, as it usually represents abdominal cavity drainage Sometimes the first manifestation of evisceration is the presence of a mass of small bowel on the abdominal wall beneath the dressings Treatment is self-evident The patient must be returned to the operating room where, under anesthesia, his abdominal viscera are returned to the abdominal cavity and the abdominal wound is closed Wound closure is usually accomplished in a through-and-through fashion, heavy black silk sutures or stainless steel wire being employed In the author's experience, any conservative means of strapping the abdominal wall together, such as with adhesive tape, has been unsatisfactory

When the only manifestation is serosanguinous drainage, the abdominal wound should be explored with a sterile instrument If the instrument can be passed into the abdominal cavity the diagnosis is confirmed Sometimes the fascia has not disrupted and the drainage is from a small subcutaneous hematoma, under such circumstances drainage of the hematoma is all that is necessary If there has been a separation of the fascia, it is the author's belief that the patient should be immediately returned to the operating room and the abdominal wall closed in a satisfactory manner with through-and-through sutures If the patient's condition is such that he cannot tolerate such a closure, conservative means of strapping may be employed It is certain, however, that the patient will develop a large abdominal wall hernia and that secondary repair will be necessary at a later date

Wound Infections

The routine surgical wound should not commonly be the site of infection Prophylaxis is the most important therapy in wound infection Careful attention to the details of aseptic technique during operation will avoid most wound infections One may expect wound infections most often

correct the continual contamination is necessary if the patient is to be saved

If one is able to combat generalized peritonitis successfully and the patient survives, one must then constantly review the patient's situation to detect the possibility of the formation of localized intra-abdominal abscesses The most common areas for such abscess formation are in the cul-de-sac of the pelvis and in the subphrenic and subhepatic areas The method of detection of these abscesses has already been mentioned

Localized abscesses may develop postoperatively without generalized peritonitis These may be manifest by localized pain, tenderness and muscle-guarding Here again, however, the symptoms may not be as marked as those which occur in association with an intra-abdominal localized peritonitis in the patient who has not had a recent operation Fever, tachycardia and localized tenderness will cause the observer to be suspicious of the presence of a localized abscess in a postoperative patient

TREATMENT OF GENERALIZED PERITONITIS Prophylactic therapy is the best treatment of peritonitis Attention to good operative technique, as already mentioned, is of primary importance The active therapy must include intestinal decompression and the administration of fluids and electrolytes in adequate amounts to maintain the patient's balance Amino acid solutions and vitamins should be given to help prevent starvation Intensive chemotherapy of a specific nature should be instituted

Postoperative Ileus

Postoperative paralytic ileus in the absence of intra-abdominal infection is an annoying complication It is manifest by cramping abdominal pain, *usually described as "gas pain " Such an ileus is usually transient in* nature and does not require vigorous therapy However, following certain operations, postoperative ileus may become quite marked and require intestinal decompression Biliary tract surgery frequently produces a considerable degree of postoperative paralytic ileus which may be combated by the routine use of a Levin tube for the first twenty-four to forty-eight hours postoperatively When a Levin tube is used in this fashion there is no retching or vomiting postoperatively and the patient is relatively free of postoperative discomfort Retroperitoneal operations, such as nephrectomy and lumbar sympathectomy, sometimes result in ileus requiring decompression

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used Such an artificial means of sustaining blood pressure must be considered as an emergency measure in "tiding a patient over" until lost blood is replaced or other states causing the shock are corrected

A severe myocardial infarction or intracranial vascular accident may be responsible for shock in the postoperative period The electrocardiogram and neurological examination will help to establish the diagnosis

Lowering the head of a patient in the state of shock to a mild degree by elevating the foot of the bed is satisfactory However, placing the bed in a Trendelenburg position hinders the patient more than it aids him, by increasing his respiratory load as the abdominal viscera are pushed against the diaphragm

The patient in shock should be kept covered to conserve body heat, but attempts to add to the body heat by the use of blankets or heating pads is condemned

Occasionally, profound electrolyte imbalance, e g, serum sodium deficit, will produce shock, although usually not in the early postoperative period Rapid replacement of sodium by giving physiological saline solution intravenously is corrective

Uncommonly, an acute adrenal insufficiency will be the cause of shock The intravenous administration of Hydrocortone may produce an almost miraculous improvement

CARE FOLLOWING SPECIFIC SURGICAL PROCEDURES

In the following section of this chapter, dealing with the postoperative care of patients having specific types of operations, some repetition is unavoidable Specific day-to-day orders to be followed after several of the more common types of operations will be given Complications peculiar to the particular type of surgery will be indicated and their management outlined

ESOPHAGEAL SURGERY

Although a great variety of surgical procedures has been carried out upon the esophagus, the commonest extensive procedure is that of resection of the lower or middle third with re-establishment of continuity by means of a gastroesophagostomy

Ordinarily the operation is performed upon patients who have considerable malnutrition with weight loss It is imperative, therefore, that these patients be fed as soon after surgery as possible To this end, many surgeons place a feeding tube across the anastomosis into the stomach Others establish a gastrostomy or jejunostomy for feeding purposes Because a vagotomy is necessarily done when the esophagus is removed,

following surgery in which the gastrointestinal tract has been opened, particularly the colon, and there has been considerable contamination When such contamination occurs, wound infection can be prevented by carefully covering the wound with laparotomy pads during the operation

Wound infections are readily recognized by the increase in temperature and pulse rate and the leukocytosis which are produced, as well as the usual local signs of inflammation They may develop while the patient is on antibiotic therapy, particularly in the many hospitals in which highly resistant strains of organisms have appeared

The treatment of wound infection is simple, it consists of adequate drainage of the infected area The commonest error that has been observed is that of inadequate drainage The patient's postoperative discomfort and hospital stay will be shortened if the initial drainage of the infected wound is adequate Cultures should be obtained of the material and antibiotic sensitivity tests made One must distinguish between a wound infection with pus formation and the infection which is of a cellulitis type, most usually due to streptococci, for which drainage offers little help Such infections may be treated with adequate antibiotic therapy as well as the application of heat locally

Postoperative Shock

Fortunately, shock is no longer commonly seen in the immediate postoperative period The decrease in the incidence of this dangerous condition is due in part to better preoperative preparation of patients undergoing extensive surgery In addition, blood replacement is usually adequate during operation and anesthetic techniques have been developed which help to protect the patient against shock

Nevertheless, a certain number of patients will have an alarming fall in blood pressure after they arrive in the recovery room It must be remembered that a lowered blood pressure is only one of the manifestations of shock Tachycardia, cold, moist, ashen skin, and gasping respiration are signs of shock which may be present before a low blood pressure is recorded Investigation of the cause of tachycardia and its treatment may prevent profound shock

The commonest cause of shock is a decreased circulating blood volume secondary to blood loss that has not been adequately replaced during operation If such a blood loss is known or suspected, adequate replacement will promptly improve the situation

Vasopressors, such as Levophed Bitartrate may be administered by constant intravenous infusion to maintain the blood pressure Nearly constant observation of the blood pressure is necessary when a vasopressor is

Every patient subjected to esophagectomy should have adequate antibiotic therapy, beginning immediately postoperatively

As already mentioned, feeding through the gastric tube may be initiated early In spite of the theoretical danger of erosion of the suture line by such tubes, my colleagues and I have allowed them to remain in place for seven or eight days The tube is then removed and the patient is allowed to take fluids orally Some surgeons do not place a tube across the suture line into the stomach, and allow an oral intake as soon as bowel activity has been resumed

A complication of esophagectomy which occurs occasionally is herniation of a portion of the abdominal contents into the chest through a rupture of the repaired diaphragm or through a defect in the newly established hiatus The suspicion of such a condition will direct the surgeon to request x-ray studies, which will reveal abdominal viscera in the chest cavity if herniation has occurred

If a gastroenterostomy or pylorotomy has not been performed at the time of operation, retention of food in the stomach after feeding is begun may present a real problem A secondary operation may be required to establish a gastroenterostomy or enterostomy for feeding purposes A late complication of esophageal surgery of this type is that of stenosis at the suture line Such stenoses may be treated by dilatation endoscopically

Obviously, there are many variations of the partial esophagectomy with re-establishment of continuity with the remainder of the gastrointestinal tract Recently, esophageal continuity has been re-established with plastic prostheses The postoperative care of such patients is essentially the same as that already outlined and the complications are the same

Operations for Cardiospasm

Operations of many varieties have been performed for the treatment of cardiospasm The care following those procedures which do not involve a resection of a portion of the esophagus is relatively simple After such procedures as the Heller operation, since there has been no violation of the esophageal mucosa, feeding may be begun early and there should be little danger of infection

GASTRIC SURGERY

Common Complications

The earliest serious complication which may be encountered following gastric surgery is that of hemorrhage Bleeding may occur into the gastrointestinal tract or into the abdominal cavity

a pyloroplasty or gastroenterostomy must be performed to avoid the complications of atony of the stomach

Assuming that a pyloroplasty or gastroenterostomy has been done, the patient may be fed as soon as bowel activity is detected It is the belief of the author that early alimentation with highly nutritious tube-feeding may help the patient to surmount the possible complications of esophagogastrostomy

Since the operation is a transthoracic one, all the care attendent upon any thoracotomy must be carried out Reference to the section on postoperative thoracotomy care is suggested

The commonest early postoperative difficulty experienced following this type of operation is a pulmonary one Atelectasis and, later, pneumonia are very common These complications must be combated vigorously by encouraging deep breathing, changing the patient's position frequently and allied measures

During the period when bowel activity has not returned, and no food is given by way of the alimentary tract, intravenous therapy must be carried out It is wise not to overload the patient with water during the early postoperative days Only enough fluids should be given intravenously to maintain an adequate urine volume and to replace the insensible loss and the fluid lost externally, as by gastric decompression drainage During the first twenty-four hours postoperatively, my colleagues and I have not used saline solutions in any form, because of the apparent inability of the kidneys to excrete salt during this period

Because of the extensive nature of the operation, it is frequently necessary to give the patient blood transfusions postoperatively, in addition to those given during operation, particularly if the amount given during surgery did not equal the amount lost This requirement for blood should be based upon the patient's general condition, the presence of a tachycardia, and upon accurate hemoglobin and hematocrit studies

Ordinarily, for the first three or four days following esophagectomy, the patient may do very well and those responsible for his care may be lulled into a false sense of security The greatest cause of death following esophagectomy is leakage of a faulty suture line This leakage ordinarily occurs on about the fourth or fifth postoperative day It results in an extensive mediastinitis, manifested by substernal pain, tachycardia, high fever, and, eventually, shock and death

Occasionally, such patients can be re-explored and adequate drainage established In my experience this has not been entirely successful Even in the hands of the best surgeons, gastroesophageal anastomoses are apt to leak because of the difficulty of performing a satisfactory anastomosis to the esophagus, which is devoid of the serous layer

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Bleeding into the gastrointestinal tract is ordinarily detected by an excessive amount of bright-red blood being returned through the decompression tube The bleeding arises from the cut edge of the stomach or jejunum at the line of the anastomosis, and is particularly apt to occur in patients with portal hypertension Ordinarily, such bleeding stops spontaneously However, the patient may require two or three transfusions to maintain an adequate circulating blood volume This troublesome complication has led many surgeons to ligate individually the bleeding points on the cut stomach wall Although re-exploration is not often necessary to control the bleeding, a patient in whom excessive bleeding is noted must be observed carefully and blood given as necessary

When intra-abdominal hemorrhage is suspected following gastric surgery the spleen must be considered as a possible source since it is vulnerable to trauma from an improperly placed retractor

The second troublesome complication is that of leakage from the duodenal stump This is apt to occur on the third to the fifth postoperative day and is heralded by increase in abdominal pain, increase in pulse rate and temperature elevation It is much more apt to occur following a gastric resection for duodenal ulcer than after the resection which is done for carcinoma or gastric ulcer In the latter instance, closure of the duodenal stump is much less hazardous, since the duodenum is usually normal

Functional ileus is not a particular problem following gastric surgery However, failure of the gastrojejunal stoma to function because of edema or some other cause is encountered occasionally Gastric decompression must be continued in such patients until the stoma becomes patent Intravenous fluid therapy should be kept to a minimum in an effort to reduce edema Although continued decompression and time usually relieve the stomal dysfunction, it is sometimes necessary to re-explore patients with this complication

Leakage from the gastrojejunal suture line is an uncommon complication of gastric surgery

Tube Feeding and Diet

It is the practice of the author and his colleagues to place an Abbott-Rawson tube in the stomach of the patient preoperatively During surgery the distal limb of the tube is passed through the distal stoma into the jejunum As soon as bowel activity has been resumed, tube feeding may be given into the distal limb of the jejunal arm Such a technique is not necessary if the patient is in a good nutritional state prior to surgery Many of the patients, however, have been in a poor nutritional state for

considerable time preoperatively By such a technique, feeding is not delayed Ordinarily, the Abbott-Rawson or Levin tube is removed on the fourth postoperative day and the patient given a liquid diet, gradually changing it to soft food by the seventh or eighth day It is the custom of many surgeons not to use gastric decompression following gastric resection They allow their patients to take food, beginning with liquids, as soon as bowel activity has returned

Specific Orders for Subtotal Gastric Resection

The following orders may be given for the care of a patient who has had a subtotal gastric resection

IMMEDIATELY POSTOPERATIVELY

1 Sedation, small amounts
2 Connect suction apparatus to Levin or Abbott-Rawson tube
3 Antibiotics
4 Check drainage for blood
5 Intravenous fluids to a total of 2000 cc , plus the blood administered during surgery
6 Routine care Frequent turning, encourage coughing, etc

FIRST POSTOPERATIVE DAY

1 Sedation, small amounts
2 Patient to sit on side of bed or in chair
3 Continue gastric suction
4 Intravenous fluids 2000 cc of 5 per cent glucose in water, plus physiological saline solution equal to the amount removed by gastric suction
5 Vitamins
6 Serum electrolyte and hematocrit determinations to be ordered depending on clinical conditions

SECOND POSTOPERATIVE DAY

1 Sedation, mild
2 Patient may sit at side of bed
3 Continue suction, or, if bowel sounds are present or flatus is passed, discontinue suction at intervals and feed through distal limb of Abbott-Rawson tube (1000 cc of tube-feeding formula in five divided, equally spaced doses)
4 Intravenous fluid 2000 cc 5 per cent glucose in water, plus physiological saline solution equal to the amount removed by gastric suction
5 Vitamins
6 Serum electrolyte determinations as indicated

THIRD POSTOPERATIVE DAY

1 Sedation, mild
2 The patient to become ambulatory
3 Continue tube feedings

FOURTH POSTOPERATIVE DAY

1 Remove decompression tube
2 Give sips of water
3 Intravenous fluids 2000 cc of 5 per cent glucose in water

Bleeding into the gastrointestinal tract is ordinarily detected by an excessive amount of bright-red blood being returned through the decompression tube The bleeding arises from the cut edge of the stomach or jejunum at the line of the anastomosis, and is particularly apt to occur in patients with portal hypertension Ordinarily, such bleeding stops spontaneously However, the patient may require two or three transfusions to maintain an adequate circulating blood volume This troublesome complication has led many surgeons to ligate individually the bleeding points on the cut stomach wall Although re-exploration is not often necessary to control the bleeding, a patient in whom excessive bleeding is noted must be observed carefully and blood given as necessary

When intra-abdominal hemorrhage is suspected following gastric surgery the spleen must be considered as a possible source since it is vulnerable to trauma from an improperly placed retractor

The second troublesome complication is that of leakage from the duodenal stump This is apt to occur on the third to the fifth postoperative day and is heralded by increase in abdominal pain, increase in pulse rate and temperature elevation It is much more apt to occur following a gastric resection for duodenal ulcer than after the resection which is done for carcinoma or gastric ulcer In the latter instance, closure of the duodenal stump is much less hazardous, since the duodenum is usually normal

Functional ileus is not a particular problem following gastric surgery However, failure of the gastrojejunal stoma to function because of edema or some other cause is encountered occasionally Gastric decompression must be continued in such patients until the stoma becomes patent Intravenous fluid therapy should be kept to a minimum in an effort to reduce edema Although continued decompression and time usually relieve the stomal dysfunction, it is sometimes necessary to re-explore patients with this complication

Leakage from the gastrojejunal suture line is an uncommon complication of gastric surgery

Tube Feeding and Diet

It is the practice of the author and his colleagues to place an Abbott-Rawson tube in the stomach of the patient preoperatively During surgery the distal limb of the tube is passed through the distal stoma into the jejunum As soon as bowel activity has been resumed, tube feeding may be given into the distal limb of the jejunal arm Such a technique is not necessary if the patient is in a good nutritional state prior to surgery Many of the patients, however, have been in a poor nutritional state for

Because of the poor nutrition of many patients undergoing gastric surgery, the incidence of wound evisceration may be slightly higher than the average in abdominal surgery

Gastrostomy

Gastrostomies are usually performed for feeding purposes and/or to aid in retrograde bouginage of the esophagus Several types of gastrostomies may be done The ordinary tube gastrostomy patient should have suction applied to the gastrostomy tube itself for twenty-four hours in order to keep the stomach free of secretions and to allow the gastrostomy opening to be sealed off from the remainder of the peritoneal cavity After twenty-four hours, clear liquids may be given into the gastrostomy opening, provided bowel activity has been resumed Nutritious tube-feeding may be given after another twenty-four hours Since gastrostomies are ordinarily performed upon patients who have very poor nutrition, the incidence of wound evisceration may be relatively high

Total Gastrectomy

When a total gastrectomy has been done, continuity of the gastrointestinal tract may have been re-established by an esophagoduodenostomy, a loop esophagojejunostomy with an accompanying enteroenterostomy, or a Roux-en-Y arm esophagojejunostomy In any of these instances, the complication most dreaded is that of leakage of the suture line This is most apt to occur in the third to the fifth postoperative day and is manifested by increasing signs of peritonitis Leakage from the duodenal stump following total gastric resection may occur, but is unlikely, since total gastric resections are ordinarily done for the treatment of carcinoma, and the closure of the duodenal stump in such instances is not difficult

Some type of feeding tube is ordinarily placed across the suture line and into the jejunum or duodenum Feeding is begun as early as possible through this tube The greatest problem postoperatively in a patient who has undergone a total gastric resection is one of nutrition This problem plagues the surgeon almost from the beginning postoperatively Small frequent feedings must be given in order to try at least to maintain the patient's weight

When a total gastrectomy has been done, there may be injury to the pancreas, particularly the tail, since the spleen is ordinarily removed Pancreatic fistulae and acute or subacute pancreatitis may develop because of the trauma to the area These may produce severe pain and fever in the postoperative period

Some surgeons perform a total gastrectomy transthoracically The

FIFTH POSTOPERATIVE DAY

1 Sedation, mild
2 Ambulation continued
3 Liquid diet

SIXTH POSTOPERATIVE DAY

1 Liquid diet
2 Sedation, mild

SEVENTH POSTOPERATIVE DAY

1 Change dressing and remove sutures as indicated
2 Soft diet

EIGHTH POSTOPERATIVE DAY

Discharge patient from the hospital with instructions as to diet

Gastroenterostomy

Gastroenterostomy alone for the treatment of duodenal ulcer is no longer commonly performed Such a procedure is usually reserved for the older patient with an obstructing lesion of the outlet of the stomach The postoperative care of such a patient is essentially the same as for the patient having a gastric resection In patients who are malnourished, an Abbott-Rawson tube is placed in the stomach preoperatively and is passed into the distal limb of the gastroenterostomy segment at the time of operation, so that feeding may be initiated early Although a gastroenterostomy which has been performed for a patient with an inoperable obstructing carcinoma does prolong life, one frequently gets the impression that it is not working well In reality the difficulty may be due to the anorexia and discomfort associated with the tumor in the advancing disease, and not to dysfunction of the gastroenterostomy stoma

Gastroenterostomy suture lines rarely are the sites of leakage However, there is still the possibility of bleeding from the stomach wall into the stomach This ordinarily is not extensive and, indeed, is not a common complication of gastroenterostomy

A gastroenterostomy with an accompanying vagotomy is a procedure commonly performed for the treatment of duodenal ulcers The postoperative care is relatively simple and is essentially the same as that following a subtotal gastric resection One need not, of course, worry about leakage of the duodenal stump, since it has not been amputated A small amount of bleeding may occur from the gastroenterostomy site, but this is rarely troublesome When the gastroenterostomy stoma has been properly placed, the atony of the stomach produced by the vagotomy is little or no problem, since the stomach can drain properly

All patients who have undergone gastric surgery may become ambulatory on the first or second postoperative day

onset of shock during and following the operation Blood replacement must be adequate, and at times it may be necessary to sustain the blood pressure by giving a vasopressor such as Levophed Bitartrate

SMALL BOWEL SURGERY

Surgery of the small bowel is generally limited to resection of diseased segments with re-establishment of continuity by end-to-end or side-to-side anastomosis Occasionally, there is need to construct free arms of small bowel by a Roux-en-Y procedure The postoperative care of patients who have had segments of small bowel removed usually presents little difficulty with respect to the specific surgery itself In a properly constructed enteroenterostomy the suture line rarely leaks However, the patients must have gastric or small bowel decompression until the return of bowel activity, which is denoted by the presence of bowel sounds or the passing of flatus After bowel activity has returned, liquid feedings may be initiated, usually by the second or third postoperative day, with gradual change to a soft diet by the seventh day By the tenth or twelfth day the patient is ordinarily eating a regular diet

Commonly, the small bowel is the site of obstruction without gangrenous change in the bowel, so that the surgery is limited to freeing the obstructed segment from adhesions, hernial sac, or the like If one is sure that the bowel is viable at the time the abdomen is closed, there is little fear of the complication of perforation of the bowel due to gangrene Again, as soon as bowel activity has been restored, feeding may be initiated with a liquid diet Until this time, gastric or small bowel decompression is carried out Since there is no suture line in these operations, the progression to soft food and regular diet can frequently be much more rapid than when a suture line is present

At times it is necessary to establish a tube jejunostomy for feeding purposes Not infrequently, gastric decompression will have been undertaken prior to the necessity for the jejunostomy feeding tube Decompression by this means is continued until bowel activity returns Ordinarily, no feeding is allowed through the jejunostomy stoma for twenty-four hours, in order to allow the wound to become sealed off For the next twenty-four hours, only clear fluids are instilled through the tube, after which nutritious tube-feeding formulas may be given

APPENDECTOMY

The postoperative care following the ordinary appendectomy is relatively simple It may vary somewhat, depending upon the pathological state of the appendix at the time of removal and the degree of

complications attendant upon any thoracotomy must therefore be considered

DUODENAL SURGERY

Perforated Peptic Ulcer

Surgery upon the duodenum is usually associated with gastric surgery However, perforated peptic ulcers of the duodenum are treated most frequently without surgery, other than that employed for the closure of the perforation itself The postoperative care of patients following treatment for perforated peptic ulcer is essentially the same as that for patients having gastroenterostomy or subtotal gastric resection After several days of decompression of the stomach, liquid feedings are begun Early ambulation is practiced All patients are placed on heavy antibiotic therapy because of the possibility of contamination of the abdominal cavity The amount of sedation required is ordinarily not high

In the later postoperative period, i e, after five to seven days, the occurrence of a fever suggests the possibility of intra-abdominal abscess formation Most frequent sites of these abscesses are subhepatic, subphrenic and in the cul-de-sac Subhepatic and subphrenic abscesses may be manifest by tenderness over the tenth rib posteriorly and their presence confirmed by x-ray studies, which may demonstrate a high diaphragm on the involved side Fluoroscopy will demonstrate an immobile diaphragm on the affected side An abscess in the cul-de-sac may be manifest by an exquisitely tender mass protruding into the rectum Ordinarily, the rectal abscesses may be allowed to drain spontaneously The subphrenic abscesses demand proper operative drainage

Bleeding Duodenal Ulcer

When surgery is undertaken because of bleeding duodenal ulceration, the postoperative care is somewhat dependent upon the type of procedure which is performed Ordinarily, ligation of the bleeding vessel alone is accompanied by some type of resection of a portion of the stomach When this is done, the postoperative care is essentially the same as that following a subtotal gastric resection Sometimes the patient's condition at the time of operation is so precarious that only ligation of the bleeding point is done Following such a procedure, careful attention must be given to the possibility of a recurrence of the bleeding due to continued ulceration Therefore, as soon as possible, intensive ulcer management should be undertaken to reduce the gastric acidity as much as possible

The patient who has had massive blood loss from a bleeding peptic ulcer prior to surgery may be in a precarious position with regard to the

onset of shock during and following the operation Blood replacement must be adequate, and at times it may be necessary to sustain the blood pressure by giving a vasopressor such as Levophed Bitartrate

SMALL BOWEL SURGERY

Surgery of the small bowel is generally limited to resection of diseased segments with re-establishment of continuity by end-to-end or side-to-side anastomosis Occasionally, there is need to construct free arms of small bowel by a Roux-en-Y procedure The postoperative care of patients who have had segments of small bowel removed usually presents little difficulty with respect to the specific surgery itself In a properly constructed enteroenterostomy the suture line rarely leaks However, the patients must have gastric or small bowel decompression until the return of bowel activity, which is denoted by the presence of bowel sounds or the passing of flatus After bowel activity has returned, liquid feedings may be initiated, usually by the second or third postoperative day, with gradual change to a soft diet by the seventh day By the tenth or twelfth day the patient is ordinarily eating a regular diet

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APPENDECTOMY

The postoperative care following the ordinary appendectomy is relatively simple It may vary somewhat, depending upon the pathological state of the appendix at the time of removal and the degree of

contamination of the peritoneal cavity When the appendectomy has been done through a McBurney incision, and the appendix had not ruptured, the patient may become ambulatory on the first postoperative day Fluids may be given by mouth as tolerated as soon as nausea disappears, and the diet may be increased rapidly during the second and third days to a general diet However, nutrition following an appendectomy is usually not important because of the fact that the incidence of appendicitis is highest in young adults in whom the nutrition preoperatively is excellent Antibiotics are ordinarily given postoperatively for four or five days when there had been any suggestion of contamination of the peritoneal cavity During the first twenty-four hours postoperatively, fluids may be given intravenously as indicated If there has been an unusual amount of nausea and vomiting postoperatively, the ordinary patient will tolerate the short period of dehydration, but it is generally believed that maintenance of a normal state of hydration will shorten the period of convalescence and increase the patient's comfort

Hemorrhage from the appendiceal artery is rarely a complication However, should there be profound shock and evidence of blood loss, this complication must be suspected and the patient re-explored, since such hemorrhage can be fatal

When the appendix has recently perforated and there is contamination of the abdominal cavity, it has been the practice of the author and his colleagues to keep the patient at bed rest for several days postoperatively, in order to increase the possibility of localization of an abscess to the pelvis should it develop The patient is kept in a slight Fowler's position for this reason also Antibiotics are given in massive doses If the contamination from the ruptured appendix has been generalized and peritonitis has developed, gastric decompression must be instituted and continued until all evidence of the peritonitis has subsided Bed rest under these circumstances is essential Alimentation must be by the intravenous route as long as gastrointestinal decompression is carried out

When an appendiceal abscess is known to be present and has been drained, the postoperative care consists primarily in frequent changes of the dressings about the drainage site The drains which have been placed in the cavity are usually of the Penrose type, and after four to five days they should be gradually removed over the succeeding three or four days The drainage of appendiceal abscesses frequently is accomplished with the patient under local anesthesia Therefore, the disturbance to the patient generally is slight

Subphrenic or pelvic abscesses may develop following appendectomy, especially when the appendix has ruptured

Specific Postoperative Orders

The following orders may be given for the care of a patient who has had an appendectomy

IMMEDIATELY POSTOPERATIVELY

1 Bed rest
2 Sedation, small amounts
3 Intravenous fluids 1000 to 2000 cc of 5 per cent dextrose in water
4 Routine care Frequent moving, encourage coughing, etc
5 Antibiotics

FIRST POSTOPERATIVE DAY

1 The patient to become ambulatory
2 Give clear liquids as tolerated
3 Sedation, small amounts

SECOND POSTOPERATIVE DAY

1 Soft diet.
2 Sedation, mild

THIRD POSTOPERATIVE DAY

General diet

FOURTH POSTOPERATIVE DAY

No special orders except medication may be given for relief of pain

Many patients are discharged from the hospital following appendectomy, especially when this has been performed through a McBurney incision, after the fourth or fifth postoperative day and return to the hospital for removal of their sutures on the seventh or eighth day Leakage from the appendiceal stump is uncommon and is apt to occur only when some disease process is present other than the appendicitis, such as amebic granuloma, actinomycosis, or terminal ileitis

ILEOSTOMY

An ileostomy may be performed preliminary to resection of the entire colon or the opening may be established at the time of total colectomy The patients who require an ileostomy, sometimes rather urgently, are usually poor operative risks and are in a poor nutritional state The serious complications following ileostomy are (1) retraction of the ileostomy opening into the abdominal cavity, (2) prolapse of the stoma, (3) so-called dysfunction of the stoma with failure of discharge from it, and (4) excoriation of the skin about the ileostomy opening due to the ileal secretions

Many of these complications have in recent years been avoided by the advancement in surgical technique The greatest advance in the technique is that popularized by Turnbull With this technique an ileostomy

bag may be applied immediately upon the completion of the operation Such a bag is of a temporary type and is made of cellophane, so that the ileostomy wound may be constantly observed through it By the immediate application of the bag, skin excoriation is kept at a minimum It is unnecessary to place a tube into the ileum in an effort to reduce contamination and excoriation of the skin The presence of a tube in an ileostomy opening enhances the danger of perforation of the ileum beneath the abdominal wall

It is the author's belief that gastrointestinal decompression should be established at the time of surgery and maintained until the ileostomy stoma has begun to function properly During this time, all alimentation must be by the intravenous route Very careful observation of the serum electrolytes, with proper replacement, must be carried out to avoid hyponatremia or hypokalemia

COLON SURGERY

Surgery of the colon may be divided into (1) those operations in which a segment of colon is resected, and primary anastomosis between the small bowel and colon, or colon and colon, is carried out, (2) abdominoperineal resection of the rectum and sigmoid, (3) colostomy, (4) total colectomy with ileostomy, and (5) colotomy

Right Hemicolectomy

The complications following a right hemicolectomy which are specific to such a procedure are primarily those of leakage from the suture line, and peritonitis secondary to contamination at the time of surgery Peritonitis may also result because of trauma to the right kidney, ureter, or the duodenum, since these structures are the most vulnerable to accidental injury during the procedure If a diagnosis of peritonitis is made and the operative area has not been drained, the abdomen must be re-explored and drainage established

The general postoperative care of such patients has already been suggested Small bowel decompression is continued until bowel activity has returned After decompression is discontinued, the patient is placed on a liquid diet followed in a day or two by a low residue diet After about ten days, a regular diet may be resumed Attention must be given to intravenous alimentation during the time when gastrointestinal decompression is being carried out Frequent checks of the electrolyte balance by means of serum electrolyte determinations must be made Antibiotics, of course, are given in large doses postoperatively

Transverse Colectomy and Left Hemicolectomy

The complications and care of such patients with a primary colon anastomosis is essentially the same as that outlined for those having a right hemicolectomy There is less likelihood of injury of the duodenum in these operations than in right hemicolectomies In a left hemicolectomy, the left ureter is vulnerable to injury and complications from trauma to it may be manifest in the first one or two days postoperatively

Abdominoperineal Resection of the Rectum and Sigmoid

The postoperative care of patients undergoing a Miles abdominoperineal resection is somewhat more extensive than that for patients having a resection of the colon with primary anastomosis In the first place, a permanent end colostomy stoma is established which may be the site of difficulty Secondly, a large perineal wound is made which is left at least partially open The perineal wound may be the site of extensive postoperative hemorrhage In addition, urinary tract complications may follow resection of the rectum, especially in males Pulmonary complications are increased in patients undergoing this type of surgery, because the perineal floor has been destroyed, decreasing the effectiveness of coughing

Both ureters are especially vulnerable to injury in this type of surgery, the left ureter being more frequently damaged than the right The ureter may be ligated with the production of a hydronephrosis More frequently the ureter is cut, followed by drainage of urine into the perineal wound, or into the abdominal cavity

The patient will have an indwelling catheter for several days postoperatively The catheter should be removed on the sixth of seventh day postoperatively After six hours, the patient should be checked for residual urine If more than 2 ounces remains, the catheter should be replaced so that overdistention of the bladder does not occur After several more days of drainage by catheter, the catheter again may be removed and a check made for residual urine Sometimes elderly males who have not previously had difficulty in voiding spontaneously will continue to have difficulty late in the postoperative period A transuretheral resection may become necessary in order that complete emptying of the bladder will occur

Ordinarily, no difficulty is encountered from the colostomy stoma However, at times, in obese patients, the colon is so short that it will not reach through the layers of the abdominal wall with ease In such patients, the colostomy opening may retract markedly before it becomes securely adherent to the fascia and subcutaneous tissue At other times, the viability of the colostomy segment is jeopardized because the blood supply to its distal end had been embarrassed by its passage through the

abdominal wall If the retraction or loss of viability occurs in the early postoperative period, it may be necessary to establish a transverse colostomy opening to defunctionalize the distal portion of the colon in order to avoid peritonitis from contamination

Gastric decompression must be carried out as long as the colostomy segment is completely obstructed It is the author's practice to hold the colostomy segment in place by means of a Kocher hemostat After twenty-four hours the clamp is partially removed to provide a gas vent After three or four days the clamp may be removed completely

The routine postoperative care of a patient having an abdominoperineal resection without complications may best be outlined by the day-to-day specific orders

IMMEDIATELY POSTOPERATIVELY

1 Sedation, mild
2 Give 5 per cent glucose in water, 2000 cc, in addition to the blood administered at surgery
3 Gastric decompression
4 Check perineal wound for bleeding
5 Routine care, e g, frequent moving, encourage deep breathing, etc
6 Connect indwelling urinary catheter to drainage tube
7 Antibiotics

FIRST POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Continue gastrointestinal decompression
4 Intravenous fluids, 2000 cc of 5 per cent dextrose in water, plus volume of physiological saline equal to the gastrointestinal drainage

SECOND POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Partially remove clamp from colostomy segment
4 Sips of water by mouth if bowel activity has returned

THIRD POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Liquids by mouth
4 Remove gastrointestinal decompression tube if bowel activity has returned and flatus has been passed
5 Give supplemental fluids intravenously, if oral intake is inadequate

FOURTH POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Liquid diet
4 Remove clamp completely from colostomy segment
5 Remove a portion of the perineal pack

FIFTH POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Remove a second portion of the perineal pack.

SIXTH POSTOPERATIVE DAY

1 Sedation, mild
2 Bed rest
3 Remove the remainder of the perineal pack.
4 Soft diet

SEVENTH POSTOPERATIVE DAY

1 Sedation
2 Bed rest
3 Irrigate perineal wound with saline solution
4 Remove abdominal sutures

EIGHTH POSTOPERATIVE DAY

1 Remove catheter Test for residual urine
2 The patient becomes ambulatory
3 Irrigate the perineal wound or institute sitz baths
4 Instruction of patient in colostomy care begun
5 Colostomy stoma irrigated by nurse with instruction to patient

NINTH POSTOPERATIVE DAY

1 Continue sitz baths
2 Ambulation continued
3 Continue colostomy irrigations

SUCCEEDING DAYS

Similar to ninth day, with discharge on the twelfth to the fourteenth postoperative day

Colostomy

Ordinarily, colostomies are performed to decompress the large bowel They are frequently done under urgent circumstances, and are of the loop type If decompression is not demanded immediately, it is best to allow forty-eight hours to pass to permit sealing off from the abdominal cavity before the loop is opened If the colon must be opened immediately, it should be done after the abdomen is closed The defect made to decompress the colon should then be closed either by suture or with a clamp in order to prevent contamination It is the author's practice to have gastrointestinal decompression instituted at the time colostomy is performed Such decompression is continued until the colostomy segment is opened and functioning During this period the fluid and electrolyte balance must be maintained by the intravenous administration of fluid and electrolytes

COLOSTOMY DRESSINGS The postoperative care following a colostomy differs slightly, depending upon whether the colostomy is a permanent end colostomy or a simple loop colostomy In the simple loop

colostomy, the opening is ordinarily not made into the colon until forty-eight hours after the operation It has been the author's practice at the time of operation to place a dry 4- x 4-inch dressing, which has been opened and made into a roll, securely around the base of the colostomy segment to help to seal it from the wound This dressing need not be removed until the fourth or fifth day, unless it is grossly contaminated with feces By the seventh day a colostomy loop may be completely transected About this time, irrigation of the colostomy stoma may be started The end colostomy segment is similarly treated After forty-eight hours the hemostat, or other appliance which has been placed across the colon to occlude it, is partially removed in order to allow evacuation of gas After colostomy stomas have been established, they are dressed with bulky dressings in order to absorb the excreta After the colon has been opened the dressing must be changed four or five times a day, depending upon the amount of fecal discharge When a tube has been placed in the colon during a colostomy procedure, because of the necessity for immediate decompression, it is usually unnecessary to dress the wound for three or four days, since decompression is accomplished through the tube

Total Colectomy with Ileostomy

A total colectomy, including the perineal portion of the colon, with the establishment of an ileostomy stoma, is an operation of considerable magnitude, frequently performed upon poor-risk patients Postoperative shock may occur and must be vigorously combated with blood transfusions and other measures The care of the perineal wound and ileostomy opening is similar to that given following a colostomy

Colotomy

From time to time it is necessary to open the large bowel to inspect the interior, either directly or by means of a proctoscope The small wounds resulting can be securely closed without decreasing the diameter of the bowel and without fear of leakage The postoperative care, if no other procedure has been carried out, is essentially the same as that employed following a celiotomy The author and his colleagues have routinely maintained gastric decompression until bowel activity has returned, because of the dire consequences which would result if leakage occurred, even though this mishap is infrequent

GALLBLADDER SURGERY

The complications following operations on the biliary tract are primarily those related to the leakage of bile and to hemorrhage Because

of the disastrous consequences of the spread of bile throughout the abdomen, with the rapidly fatal course of bile peritonitis, it is the author's belief that in all types of biliary surgery, adequate drainage must be established

The judicious use of vitamin K in the preoperative period in patients with jaundice has sharply reduced the incidence of hemorrhage during and following biliary tract surgery

Other complications which follow biliary tract surgery are those attending trauma to the common bile duct, which are manifested by either excessive drainage of bile through the drains postoperatively or the onset of jaundice on the second or third postoperative day The treatment of such complications is prophylactic and is not germane to this discussion

Cholecystectomy

Patients subjected to a cholecystectomy seem to have a disproportionate amount of postoperative functional ileus The author has prevented this complication to a large extent by instituting routine gastric decompression for twenty-four to forty-eight hours postoperatively

The specific postoperative orders are as follows

IMMEDIATELY POSTOPERATIVELY

1 Bed rest
2 Mild sedation
3 Intravenous fluids 2000 cc of 5 per cent glucose in water
4 Gastric decompression

FIRST POSTOPERATIVE DAY

1 Removal of Levin tube
2 The patient becomes ambulatory
3 Liquids are given by mouth, this is supplemented by giving 5 per cent glucose in water intravenously, as indicated

SECOND POSTOPERATIVE DAY

1 Patient ambulatory
2 Liquid diet
3 Mild sedation
4 Drain removed

THIRD POSTOPERATIVE DAY

1 Mild sedation
2 Soft diet
3 Patient ambulatory

After the third postoperative day the diet is gradually increased to a general diet The skin sutures are removed on the seventh postoperative day and the patient is discharged Antibiotics are not used routinely in the postoperative period

Cholecystostomy

This operation is not as commonly performed as formerly However, there are distinct indications for its use The patients undergoing such surgery are usually quite ill and the procedure is of an emergency nature Cholecystostomy is ordinarily done to prevent perforation of the gallbladder when it is judged not safe to remove the entire organ The operation is relatively safe and is attended with few postoperative complications, although there is the possibility of bile leakage into the free peritoneal cavity with resultant bile peritonitis Antibiotics are ordinarily indicated because extensive infection may be present within the gallbladder The cholecystostomy tube should be connected immediately to the free drainage, and the tube should not be clamped at any time in the immediate postoperative period for fear of increasing pressure within the gallbladder and possibly causing leakage

Choledochostomy

The complications and routine care following choledochostomy are essentially the same as those following a cholecystectomy

Cholecystoenterostomy and Choledochoenterostomy

In operations relating to bypassing or reconstructing the common duct, the specific postoperative complications are ordinarily those related to the leakage of bile In addition, those patients who have had a longstanding obstruction of the common duct, either complete or partial, may have markedly decreased liver function, so that the added load of surgery may precipitate severe liver decompensation The amount of biliary drainage following a choledochojejunostomy may be quite extensive, but should not cause undue alarm Ordinarily, by the sixth or seventh postoperative day, this drainage has diminished or stopped completely Bleeding from the wound edge or operative field in patients with long-standing jaundice may be troublesome, in spite of vitamin K therapy, and may require the replacement of considerable blood

In performing these operations, it is not uncommon to open the duodenum over the area of the sphincter of Oddi for careful examination of this region When the duodenum has been opened, leakage from this suture line, unless adequate drainage has been established, will result in a fulminating peritonitis

SURGERY OF THE LIVER

Surgery related to the liver proper is limited to resections of a portion of the organ for removal of tumors, for biopsy, and for the establishment

of a hepaticodochojejunostomy after the method of Longmire As in biliary tract surgery, leakage of bile from the cut edge of the liver, with the resultant possibility of peritonitis, as well as hemorrhage, is the postoperative complication most feared Hemostasis may be secured by placing mattress sutures, ligation of individual bleeding points, and allied measures However, at times it is necessary to pack the wound with gauze in order to secure hemostasis Such packs must be removed by the fifth or sixth postoperative day Their removal should be done in the operating room, so that if fresh bleeding occurs the wound may be re-packed In all surgery involving the liver, adequate drainage must be placed in order to prevent the generalized spread of bile

SURGERY OF THE PANCREAS

Patients undergoing pancreatectomy must be observed carefully in the postoperative period for evidences of intra-abdominal bleeding Ordinarily, the area of resected pancreas is adequately drained so that such hemorrhage is detected on the dressings Severe pain may develop in the mid-abdomen in the immediate postoperative period because of pancreatitis in the remaining pancreas Very commonly, when the tail or body of the pancreas is removed, a splenectomy is performed simultaneously A pancreaticoduodenostomy is an extensive procedure with a relatively high mortality, resulting from the operative trauma itself There is danger of leakage from the suture lines following choledochojejunostomy, gastrojejunostomy, and, particularly, pancreaticojejunostomy Extensive drainage of all of areas which are sites of anastomoses must be done

The complications which one is likely to encounter in the immediate postoperative period following operation for removal of a pancreatic cyst also are those related to leakage of pancreatic juice into the free peritoneal cavity The relative danger of this is dependent upon the type of operation that has been performed

SURGERY OF THE SPLEEN

Essentially the only operation performed upon the spleen is splenectomy The general complications following this procedure are ordinarily few The complications are more apt to be related to the primary disease for which the splenectomy was performed If the splenectomy has been accomplished to treat hemolytic anemia, and it is unsuccessful at relieving the hemolytic process, the intravenous administration of fresh blood may be necessary in the immediate postoperative period When splenectomy has been performed for the treatment of thrombocytopenic purpura, careful observation of the platelet count should be made because this may rise

to very high limits of over 1,000,000 per cubic millimeter It is the advice of some surgeons that anticoagulants be given when the platelet count rises above 1,000,000, in order to prevent the possibility of intravascular clotting

Because the tail of the pancreas is sometimes traumatized during splenectomy, pain in the left upper quadrant, due to subacute pancreatitis, may be a common symptom in the early postoperative period Occasionally the trauma is sufficient to produce leakage of pancreatic juice to the extent of producing at least a localized peritonitis The so-called post-splenectomy fever, which occurs on the third or fourth day and ordinarily subsides spontaneously, has been attributed to leakage of pancreatic juice into the old splenic bed

It is not the author's custom to drain the area of the splenic bed postoperatively Because many patients with hematological problems which eventually require splenectomy have been given large doses of cortisone, it is sometimes suspected that wound healing following splenectomy will be inadequate This has not been the author's experience Occasionally, a subphrenic abscess will develop, owing to contamination in the left upper quadrant Such abscesses are manifested by fever, increased white blood cell count, tenderness over the ribs posteriorly, and immobile diaphragm Such an abscess demands immediate drainage The symptoms of the abscess may for a time be masked when cortisone therapy has been given

Chapter 10

SURGERY FOR ANORECTAL DISEASE

CAESAR PORTES, M.D.

All postsurgical patients should be sent initially to a recovery room. This specifically includes patients treated for anorectal diseases. Too often anorectal operations are classified as minor procedures and it is not considered that the subjects need the special care given in the recovery room. However, these patients require relief from the marked discomfort attending their operations and, in addition, may suffer shock resulting from hemorrhage. Therefore, recovery room care is certainly indicated.

Certain general measures should make the recovery of anorectal patients smoother and reduce the morbidity. These, as well as control of constipation, diarrhea, infection, the proper handling of bleeding, urinary difficulties, pain, and care following surgery for pilonidal disease and rectal polyps, are discussed in this chapter.

CONTROL OF CONSTIPATION

Prophylaxis

The patient is advised to eat lightly before admission to the hospital. The Sulfasuxidine tablets which the patient has been taking for a week prior to admission are helpful in keeping the stools soft or liquid. Preoperative enemas are given in sufficient numbers to cleanse the bowel well.

The patient should not be permitted to become constipated postoperatively. The patient's normal bowel habits should be re-established as soon as possible following operation.

On the day on which surgery was performed, 1/2 ounce of mineral oil or similar product, is given at bedtime. A similar dose is given at

morning and at night thereafter throughout the hospital stay In addition, on the night of surgery, 2 teaspoonfuls of Casyllium (a combination of cascara, psyllium husk powder and prune powder having bulk-producing and cathartic action), followed by 2 glasses of water, are given This medication, in the same dosage, is continued nightly during hospitalization

At the end of forty-eight hours, if the patient has not had a spontaneous bowel movement, an "enema routine" is instituted as follows Six ounces of warm mineral oil are injected into the rectum slowly without too much force by means of a very fine soft-rubber rectal catheter and an Asepto syringe The oil should be retained and the patient instructed not to expel it One hour later a cleansing enema is given, a soft rectal catheter being employed to avoid trauma The patient is permitted to go to the bathroom to expel the enema The expelled material should be inspected by the nurse for undue amounts of blood If there is no bleeding, the patient is placed in a warm sitz bath A mild narcotic may be given to relieve any pain which may be present

Fecal Impaction

At the end of seventy-two hours the patient should have normal bowel movements There may be many patients, however, who, because of fear of pain following a bowel movement, do not eliminate sufficiently This may result in fecal impaction There are also patients who may believe that they are having adequate bowel movements, but in reality are not In these patients especially, there must be thorough investigation by the nurses and house staff to make certain that elimination is adequate Digital manipulation in these patients is inadvisable

The symptoms of fecal impaction are typical These are frequency of stools, small stools, urgency, tenesmus and a feeling of not having "finished the job" Usually the dressings and bed linens are soiled by constant seepage

The treatment of fecal impaction consists of giving cleansing enemas and administering saline cathartics by mouth Manual manipulation for removal of fecal impaction postoperatively should be avoided for as long as possible If, however, no results are obtained by means of enemas and cathartics, the patient must be taken to the operating room, where, under anesthesia, the impaction is broken up manually

CONTROL OF DIARRHEA

Diarrhea may be caused by the Casyllium or other cathartics that are used It may also be a result of the "enema routine" The diet may also be

a factor The complication should be recognized and corrected promptly, since frequency of stool can be responsible for much discomfort and pain

The treatment consists in the following measures

1 Discontinue the use of all bulk-producing substances and all cathartics

2 Discontinue the use of mineral oil

3 Discontinue all sulfa drugs

4 Institute a low residue diet

5 Increase the fluid intake to replace the loss

6 If necessary, use one of the following prescriptions, the first of which is especially recommended

Milk of bismuth	1 ounce
Tincture of opium camphor	1/2 ounce
Kaopectate	1 ounce
Elixir of lactate pepsin, q s ad	4 ounces

Sig 1 dram every three hours until diarrhea stops

Tincture of deodorized opium
Sig 10 drops three times a day until diarrhea stops

Tincture of opium camphor
Sig 1 dram four times a day

CONTROL OF INFECTION

Before the patient is scheduled for operation he is given a prescription for Sulfathalidine or Sulfasuxidine tablets (7 7 grains) He is directed to take three tablets four times a day for four to five days preoperatively This will "sterilize" the bowel and tends to prevent the development of infection

Oil-soluble anesthetic preparations may cause abscess formation Therefore, judicious and careful use of these agents is necessary Anchoring of hemorrhoidal stumps necessitating the burying of suture material may be another cause of infection Undue suturing should be avoided

If, after all precautions have been taken, infection does develop, the prescribed treatment consists in the administration of penicillin with streptomycin, intramuscularly, the application of hot wet compresses, and giving hot sitz baths The anal region should be kept as clean as possible at all times and antiseptic ointment and solutions should be applied If the infection persists, incision and drainage of the abscess may be necessary Antibiotics do not replace adequate surgery in the treatment of anal infections

Inguinal adenitis, secondary to infection in an anal wound, may

develop following surgery, since lymphatic drainage of the anal region is to the inguinal glands Treatment for this consists in the application of moist heat to the swollen glands

POSTOPERATIVE HEMORRHAGE

Nothing is more alarming to the surgeon than postoperative hemorrhage The nurses and the resident staff must be instructed to watch the patient carefully for any evidence of bleeding At the time of operation, if there is any oozing, Oxycel may be inserted about a Penrose drain Saturation of the dressings with blood must be investigated immediately and the source of the bleeding determined If the bleeding is external it may only be necessary to re-apply or reinforce the pressure bandages If, however, there is a small vessel that is pumping, it should be tied off at once When bleeding is noted by the patient he should be asked if he has a desire to move his bowels, and if so this should be permitted and the expelled material examined for the presence of blood clots If clots are present the surgeon should be notified immediately

A bleeding vessel may be in the anorectum at the hemorrhoidal stump When this situation exists a large amount of blood can escape and accumulate in the ampulla of the rectum, and the patient may suddenly pass a large amount of blood and clots If this happens the patient should be taken to the operating room immediately and with the patient under adequate anesthesia a search should be made for the spurting vessel A suture should be placed to control the bleeder completely rather than a simple ligature, which may slip

The acceleration of the pulse and change in the general condition of the patient may occasionally be a warning of internal hemorrhage

Hemorrhage may occur as late as seven to ten days postoperatively It is usually a result of sloughing This late bleeding will be noted by the patient, he will have a desire to defecate and will pass large amounts of blood and clots He may, at the same time, experience weakness and syncope If the patient calls to report such an occurrence he should be advised to enter the hospital at once and be observed Transfusions may be necessary and the operating room should be alerted If shock ensues, blood replacement therapy must be initiated as rapidly as possible

POSTOPERATIVE URINARY DIFFICULTIES

Because the nervous mechanism of the urinary system and of the anorectum are closely associated and since the branches of the pudendal nerve supply the voluntary sphincter muscles of both the anus and the urethra, in many instances urinary complications will develop following

anorectal surgery Because of postoperative pain associated with spasm of the sphincter muscles the patient is unable to void

Dysuria may be caused by the sutures, especially if they are buried in the muscle tissue Male patients have a greater tendency to develop dysuria than do female patients Prostatic hypertrophy in the male increases the probability of this complication

The patient must be encouraged to void spontaneously It may be necessary to stimulate the reflexes by running water in the bathroom or to pour warm water over the external genitalia, or to place the patient in a warm bath and urge him to void there If possible, the patient should be allowed to get out of bed to void Often this will make attempts at urination successful

Catheterization should be avoided as long as possible If, however, the bladder becomes distended and the patient becomes uncomfortable, catheterization should be undertaken at once In many instances, some relaxing medication such as a barbiturate will produce sufficient relaxation to permit urination, so that no further steps will be necessary At times, rather than catheterize the patient too often, an indwelling Foley catheter may be inserted and left in situ for from four to five days When this is removed the patient will usually void spontaneously, especially if he is ambulatory

While the patient is suffering from dysuria, he should be given two Gantrisin tablets (7 7 grains) four times a day

POSTOPERATIVE PAIN

Pain following anorectal surgery is a major cause of disability due to the operation The patient should be advised not to expect an entirely painless convalescence, but every effort should be made to minimize the discomfort

As soon as the pain begins after the patient returns from the operating room, Dilaudid (1/32 or 1/20 grain) should be given hypodermically The dosage can be repeated in one to two hours if necessary, provided the pulse and respiration rates are normal Demerol, Pantopon, or a similar agent may be used if preferred

On the first postoperative day, medication to relieve pain may be given orally The following prescription can be made into a capsule form and given every four hours during the entire hospital stay

Codeine	1/4 grain
Phenobarbital	1/4 grain
Phenacetin	2 grains
Acetylsalicylic acid	5 grains

A hot water bottle or an ice bag applied to the perineum may bring considerable relief to the patient

GENERAL CARE

The patient's position in bed upon return from the operating room depends somewhat upon the type of anesthesia used If a general anesthetic has been given, the patient is placed on his side until he regains consciousness After the reflexes return he may lie in any position in which he is most comfortable If a local or spinal anesthetic has been employed the patient must lie in a prone position for several hours, after which he may move to any position desired

Pressure dressings are used to control oozing of blood from the operative field These are held in place by a tight T-binder If this binder has been made snug enough to cause discomfort it may be released by the nurse

Upon awakening from the anesthetic the patient may complain of a desire to void or to move his bowels He should be reassured by the nurse or the intern that this feeling is not unusual and is often due to a postoperative spasm If, however, the urgency persists, permission to use a urinal should be granted

Fluids or ice chips are given by mouth as soon as tolerated The diet should be liquid to soft It is seldom necessary to give intravenous fluids, however, rarely the persistence of nausea and vomiting will require their use

Routinely, the dressings are removed on the first postoperative day With the patient in a left Sims' position the small Penrose drain is gently withdrawn The perianal area is then cleansed with peroxide, and Mercurochrome is applied Petrolatum or Surfacaine, Tronothane or Nupercainal ointment, or any other similar preparation, is applied to the outside and the area is covered with a sterile gauze dressing

On the second postoperative day, hot wet boric acid gauze dressings are applied to the operative field A-B dressings, also saturated in hot boric acid solution, are applied over the gauze A piece of felt or a large bath towel is then placed over all the wet dressings and held in place by a binder A hot water bottle placed against the perineum helps to retain the heat for a long time

After the second day the patient is permitted to take a tolerably hot sitz bath for fifteen to twenty minutes, provided there has been no bleeding These baths may be repeated two to three times daily After each bath a small amount of ointment is applied to the anal region, which is then covered with a gauze dressing

CARE OF PATIENTS HAVING OPERATIONS FOR PILONIDAL DISEASE

Closed Operation Method

If the pilonidal cyst has been removed by "bloc" excision and then closed, the pressure dressings which have been applied are left in place for five days Pain is relieved with narcotics, e g, 1/32 grain of Dilaudid may be given as required, but not oftener than every four hours, on the first postoperative day The dressings should be inspected regularly for bleeding If possible, the patient should not lie on the operative site There should be no immediate concern about the patient's bowel movements If, after the third postoperative day, there has been no bowel movement, the "enema routine" may be instituted

On the seventh postoperative day the dressings and the retention sutures are removed The skin sutures are removed on the tenth day and the patient is discharged from the hospital on the eleventh day

Open Operation Method

When the cyst is badly infected, the open method is used The entire cyst is excised and the cavity packed with gauze The packing is removed on the third postoperative day and hot wet compresses are applied Hot sitz baths are started on the fourth day On the fifth postoperative day the patient is discharged, but should continue the sitz baths at home The instructions for home care are as follows

1 Take hot sitz baths, especially after bowel movements
2 Keep the area as clean as possible
3 Keep the area covered with sterile gauze dressings
4 Go to the doctor twice a week for dressing changes and observation

CARE OF PATIENTS HAVING OPERATIONS FOR RECTAL POLYPS

There is no special treatment following excision, fulguration, or coagulation of rectal polyps The patient may be discharged almost immediately after operation

The instructions to the patient are as follows

1 Report any undue bleeding If the bleeding is excessive, hospitalization is required and a proctoscopic examination should be made immediately Further coagulation for hemostasis will be needed if the bleeding is from the operative field
2 Low residue diet General diet may be resumed in one week
3 Ambulation and the continuing of normal work is permitted
4 Return in two to three weeks for re-examination

If fulguration or coagulation of the base of the polyp was too severe, and especially if the polyp was on the anterior surface of the rectum or rectosigmoid, an inflammatory reaction may ensue This reaction mav simulate a low-grade peritonitis The patient should be watched for intestinal perforation Distention and abdominal pain mav occur The patient should have complete gastrointestinal rest, fluids should be given intravenously and no food by mouth or enemas should be taken If there is progression of the process, abdominal exploration should be considered In most cases the inflammatory process subsides spontaneously

Chapter 11

SURGERY OF THE SOFT TISSUES

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THYROIDECTOMY

THE GREAT MAJORITY of postoperative thyroid patients have an uncomplicated postoperative course and require little in the way of specific medication or special therapy We are concerned, however, with the 8 to 10 per cent who develop some type of complication which requires specific therapy and must be recognized early to prevent possible mortality These patients either are provided with a special nurse so as to assure continual close observation, or are placed in the intensive therapy room to be attended by its personnel

With the improvements in preoperative preparation with the antithyroid drugs and with advances in anesthesia, surgical techniques and postoperative care, the mortality due to thyroid surgery has declined in the last decade from 1 per cent to approximately 0 2 per cent Only by continuous vigilance in the immediate postoperative period can such low mortality statistics be obtained or maintained

A large portion of thyroid surgery today is performed for the treatment of thyrotoxicosis, due to either diffuse toxic goiter or nodular toxic goiter The major proportion of complications and mortality following thyroid surgery has occurred in this group of patients However, with the introduction of iodine therapy, in 1923, and of the antithyroid drugs, in 1943, the morbidity and mortality were markedly reduced in the thyrotoxic patient It is no longer necessary to operate on a patient with an elevated basal metabolic rate With the use of propyl thiouracil and related drugs, even the most toxic patient can be reduced to the euthyroid state Such drugs

also have eliminated the necessity for surgery in the partially controlled thyrocardiac, the patient with uncontrolled diabetes mellitus and in the thyrotoxic patient with hepatitis and jaundice, before an euthyroid state had been obtained

It is the purpose of this section to present the routine postoperative management of the thyroid patient, and to describe the symptoms, physical findings and immediate therapy when complications arise following this type of surgery

ROUTINE POSTOPERATIVE CARE

The routine postoperative care of a patient subjected to thyroidectomy is outlined below

1 The patient is to remain flat in bed until he is fully reactive from the anesthesia, when he may be placed in the semi-sitting position

2 The patient should be placed in a quiet area, with isolation from as much noise and disturbance as is possible

3 The blood pressure reading, pulse rate and respiration rate are noted every fifteen minutes for one hour, then every thirty minutes for two hours, and then every hour for eight hours If the systolic blood pressure falls below 100 mm of mercury or shows a precipitous rise, or if the pulse rate rises above 110, the surgeon is called

4 Any signs of respiratory difficulty or obstruction are watched for carefully

5 An emergency tracheotomy set should be available at the bedside

6 Demerol, 75 mg , is given every four hours as necessary for relief of pain

7 Deep breathing is encouraged and the patient is requested to cough every thirty minutes

8 Parenteral fluids, sufficient to maintain a twenty-four-hour urinary output of 1200 cc , are given

9 The intake and output are recorded

10 Sips of water are given as soon as nausea has disappeared The day following operation, a liquid diet is given as tolerated

11 After bed rest for twenty-four hours, ambulation is encouraged

12 Ten drops of Lugol's solution are given daily for three days

COMPLICATIONS

Hemorrhage

Hemorrhage in the immediate postoperative period due to thyroid surgery produces its lethal effects by pressure within the closed spaces of

the neck, causing respiratory obstruction with hypoxia and, finally, if allowed to persist, coma and death This is in contrast to hemorrhage in other operative areas, which endangers the patient's life through blood loss and shock

Hemorrhage in the thyroid area can be of two types arterial, from the superior or inferior thyroid arteries, and venous, from the internal jugular vein or innominate veins and their tributaries

In arterial hemorrhage, the accumulation of blood is quite rapid beneath the sutured pretracheal muscles A pressure is rapidly obtained which may equal the systolic blood pressure This may produce a rapid and almost complete obstruction of the trachea One is confronted with a postoperative patient who has been doing quite well and suddenly complains of tightness about the neck with increasing difficulty in swallowing and breathing A respiratory stridor may develop, followed by cyanosis, restlessness and, finally, coma and death Examination of the area beneath the dressings reveals a firm mass with forward projection of the wound. When such a chain of events occurs, immediate and heroic action must be taken. Where the obstruction becomes complete, the surgeon must immediately remove all clips from the wound, separate the pretracheal muscles and wipe out all clots with his fingers, at the same time, when possible, the anesthesiologist can insert an intratracheal tube to provide an open airway If an adequate airway is not obtained, then a tracheotomy must be performed Usually an anesthesiologist will not be available and the surgeon will be forced to control the bleeding with gauze pressure until the patient can be returned to the operating room where, under sterile technique and intratracheal anesthesia, the bleeding vessel can be isolated and ligated If the bleeding vessel is the superior thyroid artery, it may be retracted high into the neck, and exposure frequently is not obtained until the pretracheal muscles are cut across, if further exposure is necessary, it may be obtained by adding a vertical extension to the transverse thyroid incision along the anterior border of the sternocleidomastoid muscle

When the charge nurse first observes signs of bleeding of this nature in the postoperative thyroid patient, she should seek surgical aid immediately, and at the same time set up at the bedside a sterile tray for emergency exploration of the wound and for tracheostomy If no surgeon is available and the patient becomes completely obstructed, then the nurse should open the wound, separate the prethyroid muscles in the midline, wipe out the clots with her finger and then control hemorrhage with gauze pressure until a surgeon can be reached Such a course of action will occasionally prevent death More often the bleeding and the obstruction will not be so acute as to preclude moving the patient to the operating room,

where, under general anesthesia and sterile technique, the neck can be opened and the bleeding arrested Under these circumstances, the patient is returned to the operating room and a systematic approach for control of the hemorrhage is made only after the neck has been prepared and the anesthesiologist, with the patient under topical anesthesia, has passed an intratracheal tube and has given the patient a general anesthetic

In venous bleeding, which most frequently occurs from small veins in the skin flaps, there is a slow development of puffiness in the wound with ecchymosis frequently extending laterally and posteriorly Usually these hematomas are under little pressure and seldom produce severe symptoms or respiratory difficulty The swelling should be observed closely, and if it is progressive, or if any signs of respiratory obstruction develop, then the wound must be explored and the bleeding controlled As in hemorrhage from other sites, blood replacement with type specific blood is necessary A re-check of the patient's bleeding and coagulation time, prothrombin time, and platelet count should always be obtained

Respiratory Obstruction

Respiratory obstruction, secondary to edema and/or vocal cord paralysis, is not an infrequent occurrence when it is realized that unilateral cord paralysis occurs in approximately 1 per cent of all patients having subtotal thyroidectomies Even though the edema and paralysis are usually transient, the partial respiratory obstruction experienced in the immediate postoperative period is troublesome and frequently quite serious Some surgeons have emphasized the predilection of the myxedematous patient to develop laryngeal edema Because of this, it has been recommended that a basal metabolic test be made on all thyroid patients the day before operation, and, if the basal metabolic rate is depressed below normal, that the operation be cancelled, a blood cholesterol be obtained and the patient discharged from the hospital Iodine medication is then continued, but no more antithyroid drugs are given for a period of two to four weeks After the patient has returned to the euthyroid state, he is re-scheduled for operation

Any patient showing evidence of respiratory obstruction should be immediately examined by indirect, and, if necessary, direct laryngoscopy If there is evidence of narrowing of the glottis with an inadequate opening, either because of edema or paralysis of the vocal cords, then a tracheotomy should be elected Usually this can be done in the operating room where the patient can be positioned and the neck prepared With the patient under topical anesthesia the anesthesiologist attempts to insert an intratracheal tube If intubation is successful, the tracheotomy can be executed

with no undue concern about the respiratory exchange The intubation is performed after preparation of the operative area in the event the obstruction should become complete and the tracheotomy would become an emergency

When the postoperative thyroid patient develops a stridor with only moderate respiratory obstruction the decision as to whether or not a tracheotomy should be performed becomes difficult Frequently, close observation necessitating that the surgeon remain with the patient until the status of his respiratory exchange has become stabilized is required Under no circumstances should a nurse be left with the decision as to when the obstruction has become so severe that the surgeon should be recalled for tracheotomy The best course, when doubt exists, is probably that of performing a tracheotomy The procedure does not unduly prolong the postoperative recovery and its morbidity is nil This is in direct contrast to the fatal results of a delayed or too late tracheotomy

Hypoparathyroidism

The most common variety of clinical hypoparathyroidism is the postoperative hypoparathyroid state following surgery on the thyroid gland This may be the result of complete excision of the parathyroid glands secondary to total thyroidectomy and radical neck dissection for carcinoma of the thyroid gland It may be the result of inadvertent inclusion of the parathyroid glands in the resected tissue when thyroidectomy has been performed for recurrent hyperthyroidism By far the greater number of cases are usually mild and of short duration These occur as a result of trauma, edema, hemorrhage or temporary interference of the blood supply to the glands The variation in number and position of the parathyroid glands is so great that, even if an attempt were made to remove all the glands, only approximately 10 per cent of the persons operated upon would develop a permanent hypoparathyroidism

Hypoparathyroidism is also seen following surgery for hyperparathyroidism, when a hyperfunctioning adenoma has been removed and the remaining glands have become atrophic and depressed in function The resulting state is transitory and prolonged therapy is not required In primary hyperparathyroidism, in which no hyperfunctioning adenoma is present, too much parathyroid tissue will frequently be excised and thus a state of hypoparathyroidism is created, however, this also is usually transitory

In the absence of parathyroid hormone the kidney fails to excrete the normal amounts of inorganic phosphorus in the urine and the body also loses the ability to mobilize calcium from bone as actively as is normal If

this aberration in physiology persists for any length of time it results in a decrease in urinary phosphorus with elevation of the serum phosphorus. It is the compensatory decrease in the ionized serum calcium associated with the elevated serum phosphorus levels which produces the neuromuscular hyperirritability and the clinical manifestations of hypoparathyroidism. It should also be mentioned that it is not the level of ionized serum calcium alone which determines the tetanic manifestations. The rapidity with which the low level is reached seems to bear some relation to the threshold at which symptoms appear. It is also evident that the level of serum phosphorus bears a definite role. We have been able to relieve the patient of clinical symptoms of tetany by the use of Benemid, an agent which facilitates phosphorus excretion by the kidney, by lowering the serum phosphorus levels, and with little change in the serum calcium levels.

The chief concern in the intensive therapy room is to be aware of the possibility of the development of hypoparathyroidism, to recognize its subclinical manifestations and to begin treatment early. Tetany is the chief clinical manifestation. This syndrome is characterized by increased reaction of both somatic and autonomic motor and sensory nerves to stimuli. Clinically, tetany presents two types—latent and manifest. The patient with the latent type has no definite symptoms, but increased neuromuscular activity can be demonstrated by the Chvostek sign or by the Trousseau phenomenon. In manifest tetany, spontaneous clinical symptoms appear. These are usually first noted as paresthesias and numbness of the toes and fingers. The patient may note alternate sensations of warmth and cold with no change in body temperature. These manifestations may be followed by carpopedal spasms and/or laryngospasm, the latter occurring more frequently in infantile tetany than in the adult variety. Smooth muscle spasm may also be present and be manifest clinically by intestinal colic, vomiting, urinary retention, enuresis and/or bronchial spasm. Sudden deaths have been reported, probably as a result of cardiac spasm.

The treatment of acute hypoparathyroid tetany may become necessary following thyroid surgery, when too much parathyroid tissue has been removed, or following parathyroidectomy performed because of parathyroid adenoma. When acute spastic or convulsive symptoms develop it may be necessary to relieve the laryngeal spasm by administering 5 to 10 cc. of 5 per cent solution of calcium chloride or 10 to 20 cc. of 10 per cent solution of calcium gluconate intravenously, at a rate of 2 to 3 cc. per minute. The therapeutic effect of calcium given intravenously persists for from one to two hours. Prolonged control in the acute stage can be obtained by giving 10 to 20 cc. of a 10 per cent solution of calcium gluconate intramuscularly every eight hours. The mainstay of all long-time control of

hypoparathyroidism is calcium given orally It must also be recalled that the phosphorus intake must be limited to less than 0 5 gm per day Even though milk is rich in calcium, it cannot be used as a source because of its high phosphorus content Calcium may be supplied orally as lactate, chloride or gluconate Calcium lactate is tolerated the best It may be given in enteric coated tablets or capsules, in dosage of 4 to 5 gm per twenty-four hours, best taken one-half hour before meals and at bedtime Parathyroid hormone has its chief clinical value in the management of acute hypoparathyroid tetany It may be given intramuscularly or intravenously The intravenous route is seldom necessary It may be given in 100-unit (1-cc) doses Usually, during the acute episode, 400 to 500 units are necessary per twenty-four hours The maintenance dosage is usually 20 to 50 units per day The maximum effect is obtained in eight to twenty hours Serum calcium levels must be checked during this therapy Parathyroid hormone has not proved of value in the long-term management, since it must be given parenterally and after prolonged therapy the patient frequently develops a refractoriness to its effect Dihydrotachysterol (A T 10) has ideal metabolic activity in hypoparathyroidism It causes increased excretion of phosphorus by the kidney and also aids absorption of calcium by the gastrointestinal tract It may be given as an oral preparation Initially, 3 to 7 cc may be required daily, but, after several days, this amount may be reduced to 1 to 2 cc per day, and eventually regulation can often be obtained on 1 to 2 cc, taken two or three times a week It should be emphasized that a high calcium intake must be maintained and serum calcium levels must be checked frequently To check serum calcium levels the urinary Sulkowitch procedure may be employed The reaction to this test indicative of a satisfactory calcium level is the formation of a faint cloud in the specimen This should always be obtained If the precipitate becomes heavy, then serum calcium levels are too high Hypercalcemia may lead to marked demineralization of the skeleton and possible nephrocalcinosis with resultant renal damage Vitamin D therapy is less expensive, but not as efficient as dihydrotachysterol treatment Vitamin D may be given in doses of 50,000 to 500,000 U S P units daily During this treatment also, serum calcium levels must be checked and a high calcium intake must be maintained

Thyroid Storm

The syndrome of thyroid storm or crisis following surgery on the thyrotoxic patient has almost been eliminated by adequate preoperative preparation with the antithyroid drugs and iodine Nevertheless, patients are still seen in whom the syndrome has developed when the preoperative basal metabolic rate has been approaching normal It must be emphasized

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may be quite large When no oral intake is possible, the patient will often require 1000 cc of fluids Large doses of vitamins should also be added to the fluids

4 Iodine medications Inorganic iodine acts to promote storage of the thyroid hormone A high blood level of iodine is sought immediately This is best accomplished by giving 15 grains of sodium iodine intravenously three times a day, 10 drops of Lugol's solution are also given three times a day by mouth, if tolerated

5 Sedation The control of the patient's frantic muscular activity is essential This is accomplished by giving Sodium Amytal intravenously as often as necessary Morphine sulfate (1/4 grain) is often necessary in addition to the barbiturate It should be emphasized that, aside from the medical control of the patient's activity, attempts should be made to reduce the external stimuli from the environment and to give mental reassurance

6 Oxygen therapy This is best accomplished with a BLB mask when this is tolerated With the BLB mask, 100 per cent oxygen can be given A nasal catheter or the oxygen tent may be used if the mask is not tolerated

7 Corticotrophin Dramatic therapeutic results have been reported in the treatment of thyroid storm with ACTH The dosage has been 20 to 30 mg every six hours for from five to seven days

8 Treatment of all associated complications rapidly, such as digitalis for the failing myocardium of the thyrocardiac, insulin for the diabetic, and chemotherapy for the patient with an intercurrent infection

Infection

There is always some contamination in a surgical wound and, in spite of all precautions, approximately 0 5 per cent of clean thyroid wounds will develop infection When infection develops, a culture should be taken, the patient should be given 600,000 units of penicillin daily, and warm saline packs should be applied to the operative area Early recognition of the complication and vigorous treatment will avoid the necessity for drainage of an abscess, and most wound infections will subside without the older complication of "spitting" sutures for years following

Serum within the Wound

Serum frequently accumulates beneath the skin flaps Usually this is most marked on the second or third postoperative day It is best relieved by aspiration with a syringe and a no 18 needle Usually such accumulation does not persist beyond the seventh or eighth postoperative day

Exophthalmos

Some degree of exophthalmos is noted in approximately 30 per cent of

that securing a normal rate once is not adequate evidence of attainment of the euthyroid state The laboratory results must be rechecked, and even more important in evaluating the metabolic level are the clinical signs and symptoms Has the resting pulse returned to normal? Have the blood pressure and especially the pulse pressure returned to normal? Has the patient obtained mental calm and relaxation? Has he regained or approached his previous normal weight? Have hyperactive intestinal motility, profuse sweating and sleeplessness been controlled? These questions and their answers more adequately evaluate the patient's preparation than does his basal metabolic rate Even though the thyroid storm may be prevented by careful and adequate preoperative medication, the disturbing facts remain that the fundamental cause for the state is not known and no specific therapy has been found to date Whether the basic pathological condition is in the pituitary, thyroid, adrenals and/or liver has not been determined

The main feature in treatment is symptomatic therapy This must be pursued quickly and aggressively Whenever the diagnosis is made the following should be given immediate consideration

1 Control of hyperthermia All attempts should be made to maintain the rectal temperature below 102° F Formerly this was done by such methods as alcohol sponge-baths, with or without fans circulating over the patient to increase evaporation, by ice-water enemas, or by aspirin medication With the advent of hypothermia in anesthesia methods, two new implements have been added to the armamentarium which facilitates the control of the patient's temperature and these should supplement previous methods The first is the refrigeration blanket This provides constant dependable control of the patient's temperature The second are the so-called "hibernation drugs," such as chlorpromazine Even though some hepatotoxic effects have been reported from these drugs, if used in moderate dosage of 15 to 25 mg four times daily, this should not be a deterrent to their usage

2 Caloric intake All efforts should be made to maintain an intake of 4000 to 4500 calories per day If oral intake is tolerated, this is no problem Frequently, in the critically ill patient, a formula is given by means of a continuous drip through a small plastic catheter inserted through the nose into the stomach If nausea or vomiting is present, maximum parenteral caloric intake is accomplished by giving fructose, amino acid and alcohol combinations

3 Fluid balance Accurate intake and output records must be kept A urinary output of 1000 to 1200 cc should be maintained Because of the profuse sweating and not infrequently associated diarrhea, electrolyte losses

observation and care Some of the factors important to a low mortality and low recurrence rate in hernia surgery will be discussed in the following paragraphs

Respiratory Complications

The clinical manifestations of pulmonary disease often are a major factor in the initial development of a hernia Inguinal hernias are frequently observed in patients who also have chronic bronchitis, bronchial asthma, bronchiectasis, or a severe chronic cough secondary to excessive smoking The recurrence rate will be excessively high if all efforts are not made preoperatively to control these diseases and thereby reduce the patient's coughing paroxysms Frequently this may be accomplished by reducing the number of cigarettes smoked each day At other times it will be necessary to reduce the secondary infection by giving aerosol penicillin and other broad spectrum antibiotics, instituting postural drainage, and the like

A second concern is the patient's pulmonary reserve What is his vital capacity? What is his breath-holding tolerance? What is his exercise tolerance? The reduction of a large hernia, with increase in the intra-abdominal pressure, may so elevate and interfere with the action of the diaphragm that respiratory distress will develop When a large hernia has existed for many years, and the abdominal contents have remained in the sac, the hernial sac contents are said to have lost their "right of domicile" If they are suddenly reduced into the abdominal cavity for the first time at the time of operation, then increased tension is developed at the repair site with increased chance for recurrence The limitation of diaphragmatic motion also contributes to pulmonary complications of bronchopneumonia, atelectasis and/or respiratory distress

In the preoperative period, efforts should be made to increase the relative size of the abdominal cavity This may be done by weight reduction and by having the patient wear an abdominal support or truss so as to maintain the hernia in a reduced position for several weeks before the operation

The postoperative orders should include instructions as to turning of the patient every thirty minutes, with encouragement for deep breathing and coughing every thirty minutes Such a "stir-up" regimen will reduce the incidence of the postoperative pulmonary complications

Urinary Complications

A careful preoperative evaluation of the urinary system is essential Frequently the first clinical manifestations of a hernia occur at the time that the patient has developed nocturia and reduced size of the urinary stream Often the renal function is evaluated through laboratory tests, but

patients with primary hyperthyroidism In only a small group of these is it severe enough to require special attention In about 1 patient in 1000 it is progressive and has been known as "malignant exophthalmos" Patients having the more severe cases have been treated following thyroidectomy by irradiation to the pituitary, thyroid extract, or, finally, orbital decompression as described by Naffziger

The chief concern in the intensive therapy room is to prevent damage to the eye, especially the cornea When the proptosis is severe, the patient is unable to close the lids completely and therefore is subject to injury to the cornea from foreign particles and also from drying These patients should sleep with the head elevated to minimize the orbital edema When the lids do not close completely, eye shields should be worn continuously Above all, these patients should be followed by a competent ophthalmologist and the need for definitive therapy determined by the clinical course

Hypothyroidism

This is a late complication, appearing during the first or second month after surgery Replacement therapy is never necessary in the immediate postoperative period

Pulmonary Complications

The postoperative thyroid patient may develop any of the more common pulmonary complications such as bronchopneumonia, pneumonitis, or atelectasis Early ambulation should be encouraged to avoid these complications and also to decrease the incidence of thrombophlebitis and phlebothrombosis with their subsequent complications of pulmonary emboli

Mediastinal emphysema and pneumothorax have been reported to occur following thyroid surgery Because of their infrequency, they have gone undiagnosed and death has followed, whereas decompression of the thoracic cavity could have been lifesaving They are thought to occur as a result of rupture of an intrapulmonary vesicle with passage of air along the vascular sheaths to the mediastinum and thence to the pleura cavity and the neck Treatment consists of inserting a needle in the second anterior intercostal space on the side of the pneumothorax and removing the accumulated air If the air reaccumulates rapidly, then an intercostal catheter should be inserted and connected to a water seal drainage system as described in the chapter on Surgery of the Chest

HERNIORRHAPHY

The surgeon can be assured of a good result in surgery of abdominal hernias only by careful preoperative evaluation and diligent postoperative

If ambulation is delayed because of gastric suction, parenteral fluids, or the like, then the patient should be encouraged to move his legs frequently in bed and to exercise the calf muscles every thirty minutes while awake The parenteral administration of fluids should be divided into morning and afternoon periods, so that the patient can be walked about the room for ten to fifteen minutes both in the morning and in the afternoon Sitting on the side of the bed or in a bedside chair is discouraged because it offers pressure in the popliteal space which may contribute to the development of phlebothrombosis in the deep veins of the legs When varicose veins have been noted preoperatively, usually they should be removed before operation is undertaken for repair of the hernia, and when this has not been possible, the legs should be kept encased in tensor bandages during the immediate postoperative period

Infection

Infection is one of the most common factors in the development of the postoperative ventral hernia When infection develops in a herniorrhaphy incision, failure of the repair is frequent There will always be a few wounds that become infected in spite of aseptic technique, but this incidence may be further lowered by several preoperative and postoperative measures

When a large postoperative hernia exists with evident adherence of the bowel to the cicatrix, the bowel may be prepared preoperatively by giving intestinal antiseptics to minimize infection should the bowel be entered during the dissection We have not felt that prophylactic antibiotics were necessary in the routine hernia repair The incidence of stitch abscesses has been reduced since the adoption of routinely removing all wound dressings on the first postoperative day and leaving the wound exposed to the air This has also allowed closer observation of the wound and earlier treatment if any complications should develop

SOFT TISSUE INJURIES

The early care of the patient having minor acute soft tissue trauma is often started and completed in the physician's office or in the emergency room of the hospital or clinic However, the patient with more extensive and multiple injuries is referred to the intensive therapy unit for continued care and observation

Often the patient will arrive at the intensive therapy unit in shock He may be cyanotic and perhaps will have evidence of external hemorrhage The first concern in such a patient is to obtain and maintain an adequate airway This may perhaps be easily done by simple aspiration of blood and mucus from the oral and nasal passages At the same time, any foreign

no attempt is made to determine bladder function A simple catheterization to determine residual urine in the bladder will often reveal the cause for the patient's hernia If urethral obstruction, whether due to stricture or prostatic hypertrophy, is not relieved preoperatively, the hernia repair is doomed for failure

We have felt that in a patient having repair of a large hernia, even though there was no residual urine preoperatively, a small Foley catheter should be placed in the bladder for the first fort-eight hours postoperatively This prevents bladder distention and, secondarily, tension on the hernia repair

Gastrointestinal Complications

*Frequently the patient is first seen by the surgeon because of symp*toms referable to the gastrointestinal tract If a large hernia presents itself, then further work-up is often neglected and the symptoms are attributed to the large hernia Often a careful history and physical examination will indicate a more serious abdominal disease and this must be further investigated by x-ray and laboratory studies before surgery is attempted An anemia is often found associated with a hiatus hernia and secondary peptic esophagitis This should be corrected by giving transfusions before the hernia is repaired surgically When a postoperative ventral hernia develops, careful evaluation should be made, lest there be a partial intestinal obstruction, secondary to adhesions, that might have caused increased intra-abdominal pressure and so aided the development of the hernia

In the immediate postoperative period, paralytic ileus and associated increased intra-abdominal pressure are of concern They offer no problem in patients with the smaller hernias, but in those having large, inguinal, ventral or diaphragmatic hernias, attempts may be made to reduce the distention by passing a Harris tube twelve hours before operation and maintaining suction on this tube for forty-eight hours postoperatively, or until the patient has active bowel sounds and is passing flatus

Ambulation

The postoperative herniorrhaphy patient should become ambulatory as soon as practical Patients having the smaller repairs, in whom no gastric suction or bladder drainage is used, are encouraged to go to the lavatory, with the aid of an attendant, on the evening of the day surgery has been performed Ambulation is then encouraged to the point of tolerance of the patient This regimen has reduced pulmonary and vascular complications and has also reduced the cost of hospital care Frequently these patients are ready to return home on the fifth or sixth postoperative day

are noted If the previous therapy started for the abnormalities of respiration and circulation have been successful, then the general condition of the patient will be improved and specific therapy to certain areas or systems can be given as outlined in other sections of this book If these injuries are limited to the soft tissue of the trunk or extremities, certain principles of therapy prevail Before any treatment is given, the state of the circulation and of the somatic nerves supplying the injured part must be determined and recorded Wounds of soft parts are usually classified as contusions, abrasions, penetrating wounds, lacerating wounds, or rupture involving ligaments, tendons, or muscles

Contusions involve crushing of underlying tissue and frequently are followed by hematomas If the hematomas are quite large they should be aspirated and a pressure dressing applied Late sequelae of these injuries are infection within the hematoma and calcification within the muscles (myositis ossificans)

Abrasions involve a break in the epidermis and hence are susceptible to infection The area should be cleansed thoroughly with soap and water and a sterile petrolatum dressing should be applied If the abrasions involve the face and foreign material has been impregnated in the epidermis, scrubbing with a stiff brush with soap and water will often remove pigments which would cause future unsightly cicatrices

Penetrating wounds are usually small and their tracts narrow and deep The chief danger from these wounds is the development of an anaerobic infection If a foreign body is readily accessible, it should be removed and the wound left open to heal by secondary intention Tetanus antitoxin or toxoid should be given

Lacerated wounds require a systematic approach of cleaning, debridement and closure When the general condition of the patient will permit, the patient is taken to the operating room and, under anesthesia, the extremity is prepared with soap and water, starting at the periphery and advancing to the lacerated area The area is then shaved, if necessary, and further preparation with soap and water is made Sterile drapes are applied and debridement of the wound is performed, starting with the skin edge and slowly advancing to the deeper portions All devitalized tissue and foreign material must be removed The wound is then thoroughly irrigated with saline solution Hemostasis is obtained Closure is made with the least possible tension When there has been considerable skin loss, closure may not be accomplished except by split-thickness skin graft When bone, tendon or nerves are exposed, all efforts at closure must be made In some instances a relaxing incision or rotation of a skin flap may be justified Following closure of the wound a pressure dressing should be applied, the injured

body lodged in the mouth, such as denture, food, or smoking pipe, may be located and removed If the obstruction is within the larynx an intratracheal tube should be inserted immediately and a thorough bronchial toilet performed If intratracheal intubation cannot be accomplished an emergency tracheotomy must be done Even after an adequate airway is assured, steps must be taken to preserve it The unconscious patient, in whom no spinal injury exists, should be placed in the prone position with the head lowered 10 degrees and turned to either side This position will prevent aspiration of any vomitus which may be secondary to hypotension or abdominal injuries If there is any tendency towards obstruction due to "tongue-swallowing," the tongue may be fixed with a suture through its tip or an oral airway may be inserted

After an adequate airway has been obtained, attention is directed to the control of hemorrhage and shock External pressure will control most hemorrhages from wounds of the extremities Dextran or stored plasma instillation should be started to combat the shock Any obvious deformity of the extremities is treated by immediate splinting to avoid further injury and to help to relieve pain and reduce shock The laboratory is called to type and crossmatch blood

After asphyxia, hemorrhage, shock and any obvious fractures have been controlled or treatment for these states has been started, attention can be directed to the specific injuries present An attempt is made to obtain as full and complete a history as possible Attention should not only be directed to the character and extent of the obvious injury, but also to any coexistent concealed injuries The state of the patient's health before the injury and any disabilities which he might have had previous to the injury, that might be aggravated by the injury, are elicited The history of any previous treatment before being seen by the examiner should be obtained

The physical examination of the injured patient is often quite difficult and may of necessity be somewhat limited It must be emphasized that during the history taking and the physical examination the first rule of wound care must not be neglected, that is, further contamination must be avoided To examine the patient adequately, all his clothing must be removed This is best accomplished by cutting The state of consciousness is determined and the reliability of any information obtained is evaluated A more thorough examination of the respiratory and circulatory systems is then undertaken The possibility of pneumothorax or hemathorax is considered The cardiovascular system is evaluated as to blood pressure, pulse rate, rhythm and volume, peripheral circulation, and the like The more detailed examination of the entire body is now made and all abnormalities

to the fingertips can be checked easily by sight and palpation Antibiotics and tetanus toxoid or antitoxin are given as soon after the injury as possible

After evaluation of the injury through the history and physical examination, x-ray films of the injured part are ordered These not only allow evaluation of the bones, but also may reveal the presence of opaque foreign bodies in the depths of the wound No attempt will be made to discuss the definitive therapy of hand wounds The chief concern of the intensive therapy room personnel after the patient has returned from the operating room is to ascertain that adequate circulation is maintained to the injured part, to control pain and edema, and to make the patient as comfortable as possible The hand should be maintained in an elevated position This prevents edema and thereby aids circulation and secondarily relieves pain The tips of the fingers should be checked frequently to make certain that there is no impairment of circulation Not only temperature and color, but also sensation, should be frequently checked at the fingertips If coldness, cyanosis, or numbness develops, the surgeon should be notified, frequently, the dressings will need loosening Pain is controlled with morphine or codeine, when there is no associated head injury Usually, patients with hand injuries leave the intensive therapy unit before the first dressings are changed

TETANUS

Because of its dramatic manifestations and high mortality, tetanus has attracted the attention of surgeons since the time of Hippocrates The disease is caused by *Clostridium tetani*, a gram-positive spore-forming bacillus which is strictly anaerobic The organisms are frequently found in the feces of domestic animals and have been reported in 30 to 35 per cent of the stools of farmers and soldiers They produce an exotoxin which is both hemolytic and neurotoxic The tetanus organisms are only pathogenic when they become implanted into tissues which have been injured, either by mechanical or chemical trauma, or perhaps by an infectious process

The portal of entry of the organisms may be through a wound of any type Often the injury may be as insignificant as an insect bite or a needle prick The infection has been reported frequently in dope addicts Once the organisms have started to multiply they usually remain in situ and do not involve the entire body Their lethal effect is due to the powerful exotoxin which they produce The incubation period has varied from one to two hundred and thirty-nine days The usual period is probably between five and eighteen days

The symptoms are due to the neurotoxin which causes muscle spasm The initial complaint is frequently a stiffness of the jaw muscles, hence the

part splinted, antibiotics given for several days and either tetanus antitoxin or toxoid administered Wounds of longer than eight to twelve hours' duration, and which have advanced from the stage of contamination to that of infection, should not be closed, but should be treated with antibiotics, tetanus antiserum or toxoid, and continuous warm saline soaks, to be followed by delayed closure in forty-eight to seventy-two hours If infection with suppuration supervenes, secondary closure or healing by secondary intention is allowed

Rupture of muscles, tendons or ligaments may occur If there have been ligamentous tears, these are best treated by splinting, either with an Ace bandage or plaster-of-paris bandage, depending on the location and severity of the tear Complete rupture of an essential musculotendinous ligamentous structure requires early surgical repair This is especially true of the quadriceps, Achilles and patellar tendons, in which considerable retraction follows rupture and spontaneous healing is seldom satisfactory

HAND INJURIES

The immediate care of acute hand injuries may become necessary while the patient is still in the intensive therapy unit This is especially true in the patient who is being treated for multiple injuries

One of the most important and most rewarding services performed by the surgeon in the treatment of patients having traumatic injuries is in the proper care of acute hand injuries When improper or delayed therapy is given, the economic loss to the patient and to society is often very great

The immediate care given any open wound of the hand is based on the same principles as are discussed in the treatment of soft tissue injuries in general In the hand, however, more attention must be directed toward preservation of function

The immediate care of a hand wound should consist, first, of the application of a sterile dressing All attempts at probing or examination to determine the depth of the wound, or whether tendons or nerves have been lacerated, should be delayed until adequate definitive therapy can be given Such treatment can best be undertaken in an operating room under sterile conditions, with adequate anesthesia, good lighting, adequate exposure, and a field made bloodless by use of a tourniquet Until such time that surgical exploration can be performed, the hand should be placed in a position of function over a plaster or metal splint and held in this position with a large voluminous pressure dressing and bandage Such a dressing and splint prevent any further injury to the soft parts, provide rest for the injured part, control pain, edema and hemorrhage, and prevent further contamination of the wound The dressings are applied so that circulation

without first giving the patient a skin sensitivity test If secondary operative procedures are to be performed, administration of the antitoxin should be repeated

After tetanus has developed the treatment is as follows

1 The wound of entry is completely excised together with any foreign material The wound should be left open

2 The patient is placed in isolation in a dark, quiet room All external stimuli must be reduced to a minimum

3 The bed should be placed in a 10 per cent Trendelenburg position to help prevent aspiration penumonia A fracture board is placed beneath the mattress and the patient is given a cleansing enema

4 Procaine penicillin (600,000 units) is given intramuscularly two times daily (this is a minimal dosage)

5 *Serotherapy* is given The patient's skin sensitivity to tetanus antitoxin is determined, a 1 1000 dilution of the antitoxin being employed If the reaction is negative, 40,000 units of tetanus antitoxin are given intravenously in 300 cc of normal saline solution in a period of thirty minutes An additional 40,000 units are given intramuscularly If the patient is sensitive to the skin test dose, a similar dosage is given after desensitization The above dosage may be repeated every four hours for the first twenty-four hours Subsequent dosage is determined by the patient's response Some investigators have recommended intrathecal antitoxin, but its value is still moot

6 *Sedation* is secured Muscle spasm is controlled by the rectal or gastric tube administration of phenobarbital, 120 mg are given every four hours as necessary If this treatment is not adequate, Avertin is given rectally in doses of 50 mg per kilogram of body weight This is made up in 0 5 per cent solution and given every six hours as necessary

7 Control of laryngeal spasm may be obtained by administering 0 5 gm of Sodium Amytal intravenously An emergency tracheotomy set should be available in the room, and if the obstruction is not relieved with sedation, an emergency tracheotomy will be necessary If the respiratory failure is due to spasticity of the respiratory muscles or to paralysis of the respiratory center, a Drinker respirator may be needed to maintain respiratory exchange

8 Nutrition is maintained by giving tube feedings every four hours through a small plastic gastric tube A total intake of 3000 calories should be maintained Fluid intake should be sufficient to maintain a daily urinary output of 1000 cc

9 General nursing care is quite important and a favorable outcome

name "lockjaw" Trismus is eventually present in all subjects, but during the first twenty-four hours the symptoms may be limited to a "stiff back" or "stiff neck" As the disease progresses, muscular spasm spreads to involve the entire body When the laryngeal muscles are involved, respiratory obstruction develops and tracheotomy may be necessary Spasm of the abdominal muscles and diaphragm also limits the respiratory exchange Convulsive seizures involving the entire body eventually develop These may be precipitated by trivial external stimuli, such as bright lights, loud noises, or even the bed covers rubbing on the skin

The treatment of tetanus consists of prophylactic measures and/or therapy instituted after the disease is present

Since the organisms can only multiply in dead tissue under anaerobic conditions, proper care of wounds with adequate removal of all devitalized tissue and foreign bodies, and, when indicated, leaving the wound open, will prevent the growth of the *Cl tetani*

When a wound has been grossly contaminated, following the debridement the patient should receive, in addition to toxoid or antitoxin, 600,000 units of penicillin daily for five days

Probably the greatest advance in the control of tetanus was the development of the tetanus toxoid The experience of the United States Army in World War II stands as adequate proof of this Long was able to find only 12 cases of tetanus among 2,734,819 persons admitted to Army hospitals because of wounds or injuries There were five deaths, but only one of these was in a patient who had had adequate active immunization Glenn also noted the high incidence of tetanus among the Filipino natives during the recapture of Manila, as compared to that in the United States troops He reports 156 cases of tetanus among 1100 wounded natives, as compared to no cases in the United States troops Active immunization is obtained by three injections of tetanus toxoid at one-month intervals This should be supplemented every five years with a booster injection of the toxoid It has been shown that the serum antitoxin levels may be maintained up to eleven years after the last injection What is even more important is the fact that once a booster dose is given there is the ability to produce a high level of serum antitoxin This level is reached in from five to fourteen days after the booster injection If the patient has had previous active immunization in the last ten years, then only a 0 5-cc toxoid booster is indicated prophylactically If active immunization has not been given, passive immunization with the antitoxin is indicated Even though 1500 units have been the accepted dosage, we feel that this should probably be increased to 5000 units, since tetanus has developed in spite of the routine use of 1500-unit prophylactic dosage Antitoxin must not be administered

wounds associated with compound fractures and in those in which a large amount of devitalization of muscle has occurred Although it may follow quite trivial wounds, it is likely to develop in wounds with the following features (a) extensive devitalization of muscles, particularly in the extremities, (b) interference of the main blood supply to a limb or muscle group, produced by injury, prolonged application of tourniquet, tight packing, or application of constricting bandages, splints or casts, (c) the presence of foreign bodies, clothing or dirt deep in the tissues, (d) delay in surgical treatment, (e) puncture wounds with considerable hemorrhage or retained foreign bodies

6 Type of surgical care The most important principle of therapy of any wound is adequate and complete débridement Whenever this principle is compromised, and especially if the wound is closed without adequate debridement, the incidence of gas gangrene will be greatly increased

The signs and symptoms of the infection usually are manifest in eight to forty-eight hours after the injury There is usually an increase in pain about the wound Following soon after the increase in pain, a change in pulse and temperature will occur Frequently the first evidence of a gas infection is a marked increase in the pulse rate together with a decrease in amplitude of the pulse The pulse is usually out of all proportion to the elevation of temperature, which frequently is below 102° F In the more acute cases, there is the rapid onset of listlessness, weakness and profuse sweating and, frequently, mental confusion and stupor in the late stages The local appearance of the lesion is often of considerable aid The drainage becomes quite profuse and consists of a watery, brownish discharge containing gas bubbles with a fetid, sweetish odor The skin develops a dark, brawny edema with crepitation on palpation

Laboratory examination will reveal a marked anemia, frequently the red cell count is below 2,000,000 The leukocyte count is moderately elevated Positive blood cultures are rarely obtained X-ray evidence of gas in the subcutaneous tissues is expected, and frequently this modality may be used to demonstrate the limits of extension of the process Of course, the most important laboratory aid in the diagnosis is examination and culture of the wound discharge The demonstration of gram-positive rods with spores and also the stormy fermentation in lactose confirm the clinical impression

The treatment of gas gangrene could best be considered under the subtopics of prophylaxis, serotherapy, chemotherapy, surgical therapy and general supportive measures

The early and adequate debridement of wounds will practically eliminate the necessary for treating gas gangrene Careful debridement removes

often depends on its competence The patient must be turned frequently, with emphasis on skin care The mouth and pharynx need frequent aspirations

10 Continuous nasal oxygen therapy will often relieve a mild hypoxia that may be present Improvement in the patient's condition is evidenced by a decrease in the muscle spasm and the recurring spasmotic seizures, and a progressive decrease in the muscle hypertonicity The sedation may be slowly reduced as the muscle spasm subsides

GAS GANGRENE

Gas gangrene as a complication of contaminated wounds has long been a subject of interest to the surgeon, because of its fulminating course, profound toxemia and high mortality It is an infection which requires immediate and quite vigorous and adequate surgical therapy

There have been a large number of different anaerobic bacteria cultured from gas gangrene wounds Of these, four have been most prevalent *Clostridium perfringens*, *Cl novyi*, *Cl septicum* and *Cl histolyticum* Of these organisms, *Cl perfringens* has been present either alone or in combination in over 50 per cent of reported cases The hemolytic streptococcus has also been occasionally cultured with one of the above *Clostridia* and it alone has occasionally produced a gas-forming, necrotizing cellulitis

The toxicity from these organisms is derived from two sources The first is an exotoxin, produced by the bacteria, which hemolyzes the red blood cells The second is a toxic factor derived from the disintegrating tissues, and which is removed only by surgical excision

All wounds which are contaminated with the clostridial organisms do not develop gas gangrene infection *Cl perfringens* is ubiquitous in the human environment In a collected series of 3027 wounds of violence, in both civilian and military personnel, Altmeier and Frusta found that the average incidence of contamination by *Cl perfringens* was 14 7 per cent In contrast to the high rate of contamination, the rate of infection ranged from 0 3 to 5 per cent in a series of major open wounds There are several factors which account for these discrepancies Among these could be listed

1 Virulence of the organism

2 Resistance of the host

3 Number of contaminating organism

4 Location of the wound The muscular areas of the thighs, calves and buttocks are especially susceptible It is also interesting that Trueta found a much higher incidence in the proximal anterior thigh as opposed to the middle or lower thigh

5 Type of wound Infection has been noted especially to follow

tenance of an adequate hemoglobin level This will frequently require multiple blood transfusions Careful attention to fluid and electrolyte balance is essential Oxygen therapy is often beneficial when extreme toxicity has developed Pain is relieved with adequate doses of narcotics

The local use of zinc peroxide in the wound has been recommended by many investigators The zinc peroxide dry powder is obtained from the pharmacy All zinc peroxide is not effective and one must obtain the "medicinal grade zinc peroxide " This must be further prepared by heating in an oven for four hours at 140° C, in quantities not greater than 250 gm When prepared for application to the wound, the powder is mixed with sterile distilled water until a creamy paste is obtained It may then be applied to the wound with an Asepto syringe It is quite important that all portions of the wound be covered with a thin layer of the paste and that this coating be kept moist at all times This dressing should be changed every twenty-four hours and fresh zinc peroxide applied Frequently, further debridement may be necessary at the subsequent dressing changes

Once the possibility of gas gangrene infection exists in a wound, the patient should immediately be placed in strict isolation During the fulminating course of the disease it is preferable that the surgeons attending such patients do not participate in the treatment of "clean" surgical patients If possible, the nursing staff, aides, and doctors should not divide their work between these patients and duties in the surgical wards or operating rooms Surgery on patients with gas gangrene should be performed in the isolation room, when practical, otherwise it should be performed in an operating room where vigorous sterilization may be accomplished before further "clean" surgery is scheduled When an isolation unit is not available, it has been practical to house these patients in a medical ward, until such time as their infection has been controlled

the substratum necessary for the growth of the anaerobic bacteria It also removes many of the contaminating bacteria before they have an opportunity for growth The principles of wound care should be applied, these include (1) careful removal of all devitalized tissue and all foreign material, (2) careful hemostatis, (3) closure of the wound without tension, (4) adequate splinting of the injured part, and (5) avoidance of all constricting bandages and casts Although there is considerable debate as to the value of prophylactic administration of tetanus-gas gangrene antitoxin, it still is used extensively It should be used in all persons who have received severely contused wounds, crushed wounds, gunshot wounds, and other wounds in which, because of environment or type of injury, gas gangrene might be likely to develop After proper skin testing, one vial containing 1500 units of tetanus antitoxin, 2000 units of *Cl perfringens* antitoxin, and 2000 units of *Vibrion septique* antitoxin may be given subcutaneously If the injection is delayed, the intramuscular route should be used If the wound is quite extensive, a second vial should be given The passive immunization will last for approximately seven days

Where frank gas gangrene has developed, therapeutic doses of antitoxin should be given The substance is best given as a polyvalent antitoxin containing 10,000 units of *Cl perfringens* antitoxin, 10,000 units of *Vibrion septique* antitoxin, 3000 units of *Cl histolyticum* antitoxin, and 1500 units of *Cl sordelli* antitoxin per vial After proper skin testing, an initial dose of four vials is given intravenously This may be repeated every two to four hours if well tolerated and the patient is showing relief of toxemia A total of twenty vials may be required as a therapeutic dose

At the same time as serotherapy is started, the patient is given large doses of penicillin Even though the infection cannot be controlled by serotherapy and chemotherapy alone, definite therapeutic benefit has been obtained from large doses of penicillin Penicillin is given intramuscularly in doses of 1 million units every two hours until such time as the infection has been controlled Some investigators have also combined therapeutic doses of sulfadiazine and Aureomycin with penicillin during the acute infection with gratifying results

Surgery must be combined with the above-described methods if therapy is to be successful This consists of radical decompression of involved fascial compartments by generous longitudinal incisions and excision of all necrotic and devitalized muscle It may be possible to excise a single muscle or group of muscles and thus avoid amputation Where the process is quite extensive the only hope of cure is amputation proximal to the site of active infection

General supportive measures of value in management include main-

tenance of an adequate hemoglobin level This will frequently require multiple blood transfusions Careful attention to fluid and electrolyte balance is essential Oxygen therapy is often beneficial when extreme toxicity has developed Pain is relieved with adequate doses of narcotics

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Chapter 12

ORTHOPEDIC SURGERY

THEODORE A FOX, M D

THE GENERAL PRINCIPLES of good surgical care are certainly applicable to the postoperative management of a patient who has had an operation upon the extremities or the spine, and these principles in no way differ from those applied to the care of a patient being observed in a recovery room postoperatively after a cholecystectomy or a herniorrhaphy These principles have been adequately covered in the preceding chapters of this book

SPECIAL FACTORS IN THE GENERAL POSTOPERATIVE CARE OF THE ORTHOPEDIC PATIENT

General postoperative care, including attention to fluid and electrolyte balance, maintenance of an airway and adequate aeration of the lungs with the prevention of postoperative atelectasis, has also been thoroughly discussed However, it should be emphasized that, for the orthopedic patient, prolonged narcosis is rarely indicated, *early return to consciousness with the associated return of vital reflexes is the greatest deterrent to pulmonary complications*, especially in the pediatric and geriatric surgical patient

The special problems presented by the postoperative orthopedic patient are peculiar to the anatomical parts involved In surgery of the extremities and spine, the magnitude of the trauma accidentally inflicted prior to admission to the hospital and recovery room and/or of the directed trauma brought about in the surgical amphitheater frequently posts problems of a serious consequence to the surgeon For this reason, efficient treatment in the recovery room requires a corps of well-trained personnel —nurses as well as house officers—familiar with all possible complications attendant upon various orthopedic procedures

Antibiotics

Because of the nature of the tissue with which the orthopedic surgeon is primarily concerned, that is, bone and its tendency to harbor infection, with the resulting high morbidity and possible mortality, many clinics advocate prophylactic administration of antibiotics This is moot, and no further discussion will be entered into on this subject However, with the advent of antibiotics, bones known to, or suspected of, harboring infection are now more frequently and more promptly operated upon than formerly, and these patients should have appropriate antibiotics administered to them immediately postoperatively, as well as preoperatively, in order to prevent flare-up of the infections following the usual extensive surgical trauma associated with this type of surgery

Surgical procedures anticipated to be long and time-consuming with prolonged exposure of large wounds require that antibiotics be administered to the patient

Blood Transfusions

Blood transfusion has proved to be a boon to the orthopedic surgeon as well as to the general surgeon, allowing surgical procedures of greater magnitude to be performed with relatively greater safety to the patient than heretofore possible prior to the establishment of blood banks Adequate amounts of blood should be prepared and be on hand for immediate use before and during surgery The need for the postoperative administration of blood, either as a result of greater blood loss than the amount replaced during surgery, or because of evidence of further loss after surgery, should be quickly detected in the recovery room and should be noted before the condition of the patient is emergent or critical

Careful and accurate observation of the patient's dressings, plaster-of-paris or otherwise, is necessary to determine the rate of postoperative blood loss

If the dressings are rapidly saturated so that the outer covering and/or the bedclothes are stained, this is, of course, indicative of rapid exudation of blood from the operative site Spine fusion wounds, and especially iliac donor-site wounds, are known to bleed freely, but the dressings usually will become saturated within two to four hours, following which there is rarely enough seepage to soak through the outer covering This early minimal "occult bleeding" represents expression of trapped blood or hematoma and is desirable If, in the judgment of the experienced recovery room personnel, the bleeding is excessive, measures should be taken to replace the lost blood at once

Blood stains on the cast are quite frequently noted, because the moist

Chapter 12

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By outlining the margins of the blood stain with a pencil and noting the time and date, further observation will indicate the activity of the bleeding by the change in the outline, that is, increase in size or configuration of the blood stain denotes continuation of bleeding (Fig 1)

Active bleeding may cause blood to run out of the top or the bottom of the cast, gravitating to the most dependent part of the extremity This also should be a warning to the observer

CARE OF THE SEVERELY INJURED PATIENT

At this point, a discussion of the severely injured patient is in order Such a patient will have been brought to the recovery room, not from the operating theater, but from the street and will be in need of the services of trained personnel who can prevent and/or treat the immediate complications of severe trauma

The first objective of the house officer charged with the responsibility of the immediate care of this patient should be to institute measures to prevent shock The prevention of shock is much more easily accomplished than is its successful treatment

First, blood loss is prevented by the application of pressure dressings to obviously bleedings wounds Next, attention is given to relief and prevention of pain The proper narcotic should be judiciously selected and quickly administered Obvious fractures are *gently* splinted to prevent fracture-site motion, which, of course, produces pain During further examination the patient is handled gently to minimize the amount of pain caused by manipulation and/or movement

After the patient's immediate needs are provided for as described above, a careful, *complete* physical examination is performed *gently* and the findings are recorded on the patient's chart, following the history which notes the how, when and where of the injury

One of the major errors in the treatment of traumatic emergency patients lies in overlooking, and consequently neglecting, the associated *less-obvious injuries*, much to the patient's discomfort, and the young surgeon's discomfiture

The injuries most frequently overlooked and a few pointers on how to detect their existence are discussed in the following paragraphs

1 *Head injuries* There may be a *history* of unconsciousness or disorientation Careful inspection is made of the head for lacerations, especially in the scalp, that are not actively bleeding and for hematoma of the scalp Swelling and/or discolorations of face are noted, as well as inequality of the pupils and paresis or paralysis of the facial muscles It should be remembered that coup-contra-coup brain injuries cause brain damage with-

plaster attracts blood by capillary action However, one must be aware of the amount and rate of saturation in order to determine if the bleeding beneath the cast is "active" or not

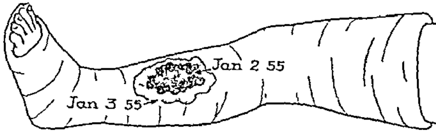

Fig 1 Activity of bleeding observed by noting outline of blood stain at different times

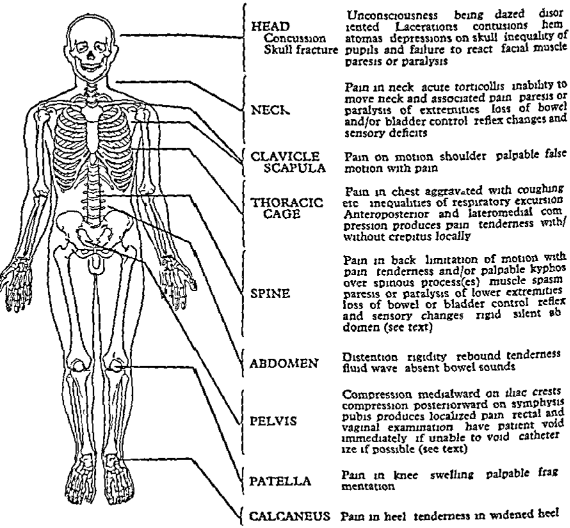

Fig 2 Concomitant injuries frequently overlooked in the severely traumatized patient

pelvis has been fractured The patient should be asked to void as soon as possible, and the specimen should be examined for gross as well as occult blood If the patient is unable to void, he should be immediately catheterized, and if the latter is impossible and there is a bloody show at the urethral opening, one must suspect a ruptured urethra Pain in the flank without pain in the pelvis in response to "compression" tests on the pelvis, plus a bloody urine, should make one suspicious of trauma to the kidney or hydrostatic pressure rupture of the bladder, in counterdistinction to the laceration of the bladder by a bone fragment in a fractured pelvis

Fracture of the calcaneus, especially in patients who have fallen from a height, should be looked for When this bone is fractured, compression of the heels will produce pain, and swelling and ecchymosis may be observed locally over the heels

6 *Spine injuries* These are very frequently overlooked Careful palpation along the spinous processes for evident kyphos or tenderness is helpful in the detection of injuries, as is palpation along the paravertebral muscles, especially in the lumbar spine for possible transverse process fracture A complete neurological examination to reveal changes in muscle power, sensory changes and reflex changes due to associated cord damage is necessary Inability to control the urine or the bowels would point to the possibility of cord damage

7 *Abdominal or visceral injuries* The abdomen also should be carefully examined for distention, rigidity, tenderness and rebound tenderness Percussion for shifting dullness is important Bowel sounds should be auscultated A "silent" abdomen is especially significant, with other signs, of solid or hollow viscus injury, but it must be remembered that a reflex ileus is common in persons having severe injuries to the back and pelvis, and is due to retroperitoneal hematomas causing peritoneal irritation

CARE OF THE POSTOPERATIVE PATIENT

Prior to starting the operation and while the operation is in progress, the recovery room should be made ready to receive the orthopedic patient It is best to move the patient directly from the operating table to his orthopedic bed to minimize further disturbance by another move from the cart or stretcher to the bed Blood should be easily available for transfusion

Appliances or equipment necessary for the care of the patient should be in readiness, such as a bedboard for placement under the mattress of a patient having a spinal operation, proper frames to support traction devices for a patient having hip joint surgery, cast driers, and cradles to keep the bedclothes off a wet cast

out evidence of external trauma, and therefore reflexes should be evaluated and sensory pattern deficits searched for It should also be recalled that a subdural hematoma may have delayed objective findings and that the patient with middle meningeal artery damage experiences a lucid interval

2 *Neck injuries* The patient may hold his head in a peculiar position This may be due to an acute fixed torticollis or the inability to move the head actively because of pain Usually, gentle palpation over the spinous processes of the cervical spine may reveal a palpable kyphos or "shelf" that is tender, local tenderness may be elicited in the midline of the neck, or vertex pressure may produce pain in the neck Spasm of the paravertebral muscles may be noted Neurological examination should be made to detect muscle weakness, reflex changes and sensory changes *Forcible correction of an acute torticollis and neck injuries is contraindicated, as this maneuver may cause sudden death by severance of the cord*

3 *Chest injuries* Fractured ribs are most frequently overlooked They are manifest by inequality of respiratory excursion with pain on deep inspiration, pain in the ribs on compression of the thoracic cage in the anteroposterior and lateromedial planes, tenderness in the ribs on local palpation with or without crepitation, increased or absent breath sounds, fullness and diminished breath sounds (hemothorax), increased tympany with diminished breath sounds with shift of the mediastinum as determined by palpation of the trachea (pneumothorax) and palpation of the chest wall for subcutaneous crepitus (surgical emphysema) Open and sucking wounds of the chest wall should be immediately closed by application of a firm dressing

4 *Upper extremity injuries* In the upper extremities the fractures that are usually missed are those of the clavicle and those of the scapula

Fracture of the clavicle is easily detected by gently palpating along this subcutaneous bone to elicit false motion and associated pain Fracture of this bone occurs usually at the junction of the middle third and outer third

To detect fracture of the scapula the region of the shoulder blades is palpated for crepitus Pain in the back upon motion in the shoulders beyond 90 degrees is an indication of fracture of the scapula

5 *Lower extremity injuries* The most easily overlooked fractures and associated trauma in the lower extremities are fracture of the pelvis, bladder and urethral injuries, and fracture of the calcaneus

Fracture of the pelvis may be easily suspected if compression medialward on the iliac crests or posteriorward over the symphysis pubis produces localized pain *in the pelvis The pain will occur at the site of the fracture*

Bladder and urethral injuries must always be suspected when the

antibiotics, narcotics and sedatives should be clearly stated The administration, if necessary, of oxygen and carbon dioxide should be ordered

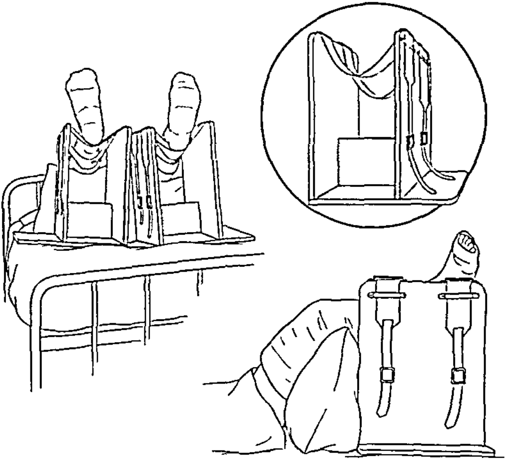

Fig 4 Elevation of lower extremities with a Chandler leg elevator

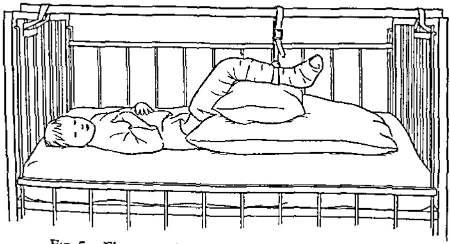

Fig 5 Elevation of lower extremity of pediatric patient

Special instructions concerning the handling of wet casts and the necessity for care in this procedure in order to prevent breaking the cast must be given to the nurses and attendants, for example, to prevent breaking the cast, a patient in a hip-spica should never be lifted by the foot-end of the cast

Elevation devices should also be provided and are illustrated in Figures 3–7 These devices are necessary in order to place the extremity in an elevated position to prevent stasis with associated excessive postoperative swelling and reaction At the end of this chapter, other orthopedic equipment necessary to be kept on hand in a recovery room is listed

Postoperative orders should be clearly written and should include directions for the general care of the patient and for the care of the local part upon which surgery has been performed

The general orders should include instructions pertaining to fluid and electrolyte balance The amount of fluids and blood in total cubic centimeters to be administered should be given Dosages and schedules for

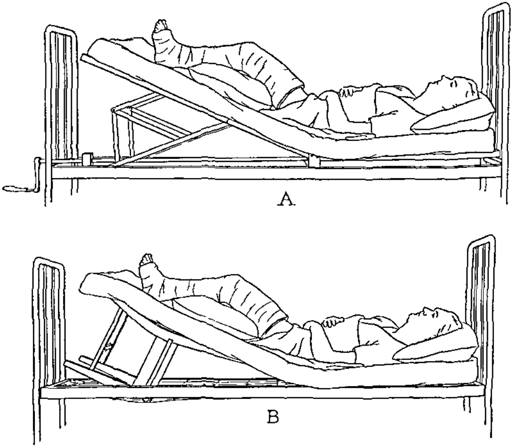

Fig 3 Elevation of lower extremity by raising lower portion of matress

difficulties that might be detrimental to the patient's recovery For example, watching the circulation in the toes by palpation for skin temperature as well as observation for color should be written in the orders

After manipulative or operative surgery of the extremities, especially when associated with the application of any retaining apparatus such as a splint or cast, the patient must be protected to prevent possible disturbances to the circulation of the part and should be carefully watched for the first signs of embarrassment to arterial flow or venous return The fingers and toes must be exposed at least in part so that constant surveillance may be maintained until all danger from pressure caused by swelling due to an acute reaction has passed

The cardinal signs of disturbance to circulation are

1 *Pain* of a burning, excruciating type, usually in one locality rather then generalized Because deeply anesthetized patients have a long recovery time, and during the semiconscious state may have acute circulatory embarrassment without being conscious of the associated pain, provides further reason why early return of consciousness is necessary in the orthopedic patient

2 *Cyanosis* or *blanching* The former is usually due to superficial pressure and resulting venous stasis, while sudden blanching, the more serious, is due to ischemia from arterial impairment, possibly thrombosis or arterial spasm Compression of the nail with slow return of color is indicative of venous stasis

3 *Swelling* This is usually associated with pain and/or cyanosis or blanching

4 *Coldness* This also is associated with pain and/or cyanosis or blanching, and usually is not an isolated finding

5 *Diminished sensation* If this is mild, it is usually associated with venous stasis, but if severe to the point of anesthesia, then damage to the nerve is to be suspected If it occurs in the immediate postoperative period, one may suspect surgical trauma to the nerve, but if it develops at some time after surgery, pressure by the cast or other appliances should be suspected as a cause for the sensory changes, as circulation to the nerves may be impaired as well as to the skin or other structure The common sites for nerve pressure by an appliance are at the neck of the fibula where the common peroneal nerve can be compressed, in the upper arm at the junction of the upper middle thirds where the radial nerve is traumatized, and at the elbow in the ulnar region These locations are the most vulnerable A test for motor impairment in the latter instances should give one a clear-cut impression as to the cause for the patient's sensory disturbance

Directions for local care should also be adequate and specific They should include positioning of the part and the method of maintaining this position The personnel should be alerted for any signs of circulatory

Fig 6 Elevation of upper extremity on a pillow

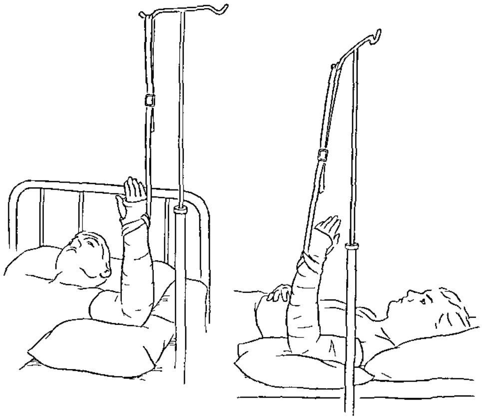

Fig 7 Elevation of upper extremity by use of adjustable stand

Appliances should be prepared so that quick action may be taken by the house officer or the attendant to relieve pressure, that is, implements should be on hand for splitting casts longitudinally down their anterior surface or for bivalving them down the sides to and including the underlying padding so that they can be immediately spread or bivalved by separating and/or removing the top half to relieve compression of the part. *Underlying swelling inside an unyielding rigid dressing can cause serious circulatory embarrassment*

It is important that the underlying padding be cut or in some way separated down to the skin either with a scissors or by a sharpened "buttonhook" (see illustration) which can pick and split the underlying sheet-wadding quite easily after the cast is spread The instrument employed should be sterilized in order to prevent contamination of a nearby wound

If improvement in subjective and objective symptoms does not result after the above measures have been employed, it may be necessary to remove the entire appliance as well as the dressings in order to save the part, even if this means loss of fixation or possible contamination of a wound

Arterial occlusion, as a result of thrombosis or spasm, is a subject discussed elsewhere in this book Arteriograms are necessary to locate accurately the site of the occlusion, but steps should be immediately taken

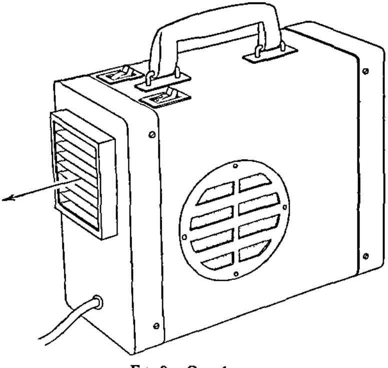

Fig 9 Cast drier

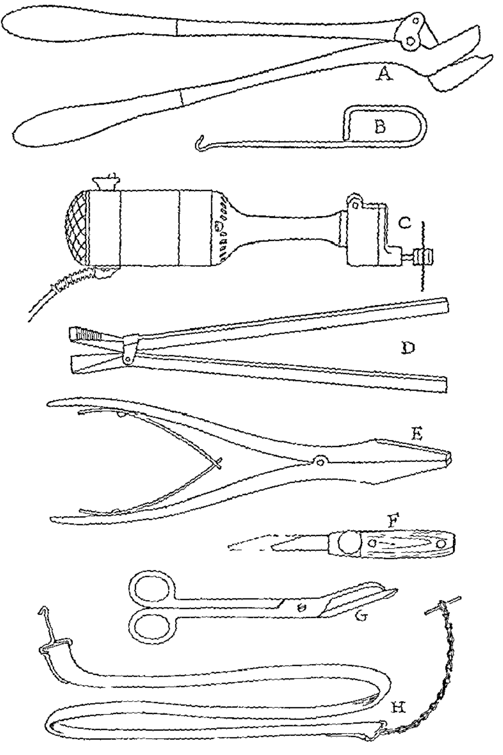

Fig 8 Some of the instruments needed for adequate recovery room care of orthopedic patients A, Hand-type cast cutter B, buttonhooks, C electric cast cutter, D and E, cast spreaders F cast knife, G, cast scissors, H rubber Martin-type tourniquet

Chapter 13

UROLOGICAL SURGERY

ROLAND R CROSS, JR, M D

SPECIAL PROBLEMS

IN ADDITION to principles of general surgery which have already been enumerated, there are certain special problems in urological patients These concern hemorrhage, urinary extravasation, maintenance of urine formation, insurance of adequate channels for the urine to pass through, acute urinary retention, acute renal failure and uremia The age of the patient is very important, for one may be dealing with the very old who have prostatic hypertrophy, or, at the opposite extreme, the very young with bladder neck obstruction due to a congenital lesion Hemolysis involves the recent problem of hypotonic solutions getting into the venous channels and venous plexuses around the prostate at the time of transurethral prostatic surgery In addition, the position of the patient during surgery is known to be a strain

Hemorrhage

Hemorrhage is always a problem to anyone dealing with patients who have had accidents or been subjected to surgery It is especially important in persons with involvement of the urinary tract The bleeding may be internal and not easily detected The kidney is a vascular organ with very little ability to contract If it is cut or lacerated, it may bleed constantly and slowly for a long time Watch should be maintained for a mass of increasing size The blood count must be made at regular periodic intervals If it is decreasing slowly, this may be due to bleeding into the tissues The color of the patient should be observed, note being made as to whether or not he is pale Increase in pulse rate and drop in blood pressure are other signs to be observed The change in blood pressure may be one of the last signs

to relieve the situation such as (1) sympathetic block, (2) continuous spinal anesthetic, (3) surgical intervention and (4) sympathectomy

SPECIAL EQUIPMENT NEEDED FOR CARE OF ORTHOPEDIC PATIENTS

The following special equipment is required in the recovery room for the care of the orthopedic patient

- Rubber Martin-type (quickly applied) tourniquet
- Cast cutters
  - Electric
  - Hand type, small and large
- Cast spreaders
- Cast knife
- Buttonhook
- Cast scissors
- Bedboards
- Elevation devices
- Cast driers
- Cradles

SAMPLE ORDERS

Postoperative orders for patients who have had upper or lower extremity surgery might include the following

1 Elevate the part
2 Watch the circulation in the fingers
3 Encourage the patient to move his fingers when he has recovered from the anesthetic
4 Encourage the patient to breathe deeply and cough every fifteen minutes for the first three hours after he has awakened
5 Give narcotic of choice in minimal dosage every four hours as required for relief of pain Remember that the aged and young require much lower dosages of narcotics than do persons who are not in the extremes of life The patient should not be narcotized, but should be given only enough of the medication to relieve his pain
6 Give antibiotics as indicated
7 Give fluids and diet as tolerated
8 Administer fluids and blood intravenously as needed

Postoperative orders for patients who had had spinal fusion are the same as those for patients having upper and lower extremity surgery except that these patients must be kept on their backs for first three hours, and then turned from side to side every four hours They should be encouraged to move their lower extremities to prevent venous stasis

has been damaged, it would be wise to seek urological consultation, if available

Maintenance of Urine Formation

IN THE GLOMERULI In all patients, whether specifically urological or not, one must make every effort to aid the kidneys to perform their job of producing urine This entails careful attention to the factors that enter into glomerular function Fluids move across the glomerular membrane by virtue of the filtration pressure, which is the amount that the blood pressure exceeds the osmotic pressure A patient who is in a state of hypotension and who has normal osmotic pressure will obviously have very little filtration pressure In all patients subjected to major surgery it is important that the value of the blood proteins be known, because these proteins are the main factors in maintaining osmotic pressure If their value is too low, it must be built up prior to surgery A normal blood pressure must be maintained When the blood proteins are normal, producing normal osmotic pressure, the blood pressure itself must be maintained The patient must not be kept in a state of hypotension for too long a period Prolonged hypotension is probably one of the main causes of oliguria in the first postoperative day, for example, during and after surgery the patient's blood pressure is low, even if not at actual shock level, and therefore the filtration pressure is too low to produce normal amounts of urine Narcotics themselves are mild antidiuretics, so they, too, will help produce the picture of oliguria Consequently, observation must be constant for indications for the administration of blood, plasma, concentrated albumin and solutions of electrolytes

IN THE TUBULES At the same time that efforts are being put forth to maintain glomerular function, the physician must also be aware of tubular function The work of the tubules may be interfered with by many things At one time a great deal was made of "lower nephron nephrosis," a term now regarded as unsatisfactory by most authorities Nevertheless, it describes the condition due to interference of varying degrees of the function of the tubules by such factors as the reaction of mismatched bloods, the intravenous administration of hypotonic fluids during transurethral surgery, various poisons such as bichloride of mercury, and severe cloudy swelling due to infection involving the kidneys or prolonged periods of hypotension It is for this reason that it is important to know the urinary output during the first two or three days postoperatively, after the ingestion of some poison, or following some trauma If a sufficient number of tubules are blocked, either by a precipitate of protein of hemoglobinuria, or of sloughing tubular epithelium, the patient will have varying amounts of oliguria up to and, possibly, even including anuria When this occurs the

to develop, because compensation may keep the blood pressure elevated even though bleeding is taking place

In prostatic surgery a great and continuous loss of blood may take place Hemorrhage is the main postoperative danger Not only is there the problem of blood loss itself, but the escaping blood may clot and block the urinary tract or its inlying catheter A bladder full of clots may produce pain attended by an extreme desire to urinate, and, yet, the patient may not be able to pass the large clot Following prostatic surgery, a bladder distended with clots may also distend the prostatic bed, which, in turn, may produce more bleeding from the prostatic bed

If many clots are formed before the bleeding is discovered, the catheter itself may be completely blocked If this occurs, the clots must be carefully evacuated An Asepto syringe is unsatisfactory for this, because its suction is too weak A plunger-type syringe, such as a 30- or 50-cc ordinary syringe (but not a Luer-Lock, for its tip will not fit the catheter) should be used A Toomey syringe is especially recommended Sometimes the wall of the catheter is too weak to withstand the pressure of the syringe, in which case the catheter will collapse when aspiration of the clots is attempted For this reason, it is well to put a large-caliber metal catheter through the urethra The no 24 F cystoscope sheath or the resectoscope sheath can be used for this purpose, if a regular metal catheter is not available One should always have a large-caliber catheter or sheath on hand It is almost impossible to aspirate clots through anything smaller than a no 22 F catheter If the blood vessel that has been opened up is so large that bleeding is vigorous and cannot be controlled by evacuating the clots and employing continuous irrigation, it may be necessary to re-insert the resectoscope and fulgurate the bleeding site, or to expose the site through a suprapubic incision and re-fulgurate the area

Urinary Extravasation

When urine is formed and the normal passages are blocked, the urine will seek other avenues of escape Urinary extravasation is serious, for urine is toxic both to tissues and to the body in general The patient with severe urethral strictures may develop a marked extravasation The urine may escape through a periurethral abscess or a phlegmon proximal to the stricture It may escape from any portion of the urinary tract that may be injured, torn or cut by any accident or surgical procedure In operations adjacent to the urinary tract, or actually involving the urinary tract, one must drain the area and try to encourage normal egress of urine A patient with urinary extravasation will have fever, lethargy, and toxicity which will be more severe than one might expect If some portion of the urinary tract

When a patient has a full bladder, it must be decided if the patient can be allowed to stand up to try to void Many persons, especially men, are unable to void in the reclining position, even if in good health

If catheters or drainage tubing have been placed into any part of the urinary tract, either at operation or following, these must be drained The drainage may be either open (Fig 1), closed (Fig 2), or tidal (Fig 3) Some type, however, must be initiated, or, otherwise, the catheter in the channel will simply act as a dam across the outflow of urine

In open drainage (Fig 1), the tubing is connected to a simple tube leading to a bottle The cavity being drained is kept collapsed To irrigate

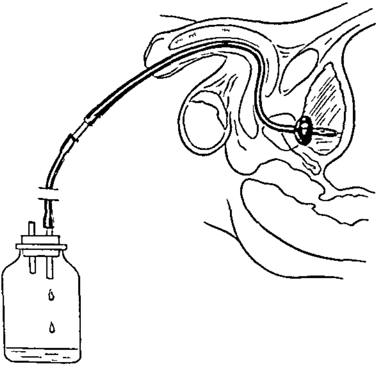

Fig 1 Open drainage

it, the system must be opened up and the irrigation carried out with the aid of an Asepto syringe Routinely, one might well irrigate such catheters with normal saline solution, however, this can be varied, depending upon the state of the bladder and the desired effect One may wish to use potassium permanganate solution or, at other times, Suby's solution Catheters which are only to be in place for a day or two may not require irrigation unless there is bleeding

In the closed drainage system (Fig 2), the catheter and its tubing lead through a glass Y-tube, one arm of which leads to a container of irrigating fluid and the other to a drainage bottle At periodic intervals, the tube draining the urine can be clamped off and the clamp from the irrigating

patient's fluid intake must at once be carefully balanced against the sensible and insensible fluid loss

In genitourinary surgery, there is little place for mercurial diuretics In most instances, their use represents whipping an animal which is already tiring in trying to do its work One should make every effort to locate the cause of the disturbance and attempt to correct it This is particularly true following surgery or trauma that disturbs kidney function suddenly from its previous normal state

Adequate Channels for Urinary Drainage

Urine that is formed by the kidneys must be allowed to leave the body, and through normal channels, whenever possible This is important in the first few hours after any major procedure, when urine may be formed and carried down to the bladder but can go no further The complication of acute urinary retention in the bladder is frequent following surgery or severe trauma, or in any patient in a complete or partial comatose state, or in a depressive state

In any intensive treatment room, one must be prepared to catheterize the patient To catheterize a patient at a certain time routinely if he has not voided, i e, eight hours after surgery, is bad practice The patient should first be examined to determine if the bladder is palpable or percussible The length of time that the patient may have been in shock and, thus, not forming much urine should be taken into account The amount of fluids given should be considered, as well as the possibility that the administration of fluid was not started immediately upon being ordered All such factors must be taken into account before it is decided whether or not the patient has a full bladder

Following surgery, the patient may be in a state of anesthesia of sufficient depth to be unabe to react to minor degrees of stimulation During this period, the bladder may become full, continue to fill and become overdistended With overdistention, the patient, even though conscious, cannot initiate the act of urination Sometimes he may be conscious, but still not aware of stimuli arising from a full bladder Abdominal manipulation at surgery may have produced sufficient stimuli to the sympathetic and parasympathetic nerves to bock out stimuli arising from a full bladder This may be especially true if the patient received fluids too rapidly during the immediate postoperative period If the patient is not in shock and is receiving fluids, but is not able to drink a sufficient amount, the fluids administered intravenously should be given very slowly The patient who receives most of his intravenous fluids during a period when he is awake may be able to react to stimuli coming from a full bladder

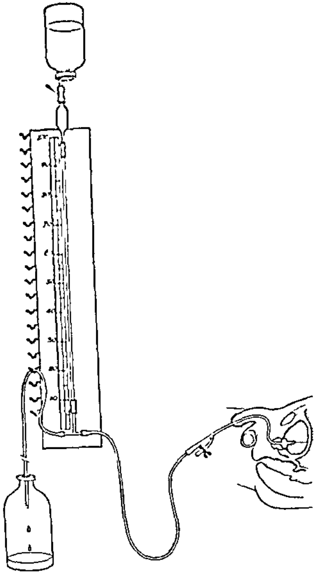

Fig 3 Tidal drainage

acid solution should definitely not be used, inasmuch as there have been reports of too much absorption of the compound It may be desired to use potassium permanganate or some other solution

In tidal drainage (Fig 3), a system is arranged whereby the cavity such as the bladder is automatically gradually filled and periodically emptied When the intravesical pressure is sufficient to lift a column of fluid to the height of the syphon arm, this syphon action is initiated and the bladder will be drained This is designed to prevent overdistention or contracture of the bladder In actual practice, this system is difficult to maintain It takes extremely well-trained personnel, such as an abundance of senior medical students, to keep it in adjustment The system must be readjusted each time the patient is turned, or an extra pillow or pad of any sort is

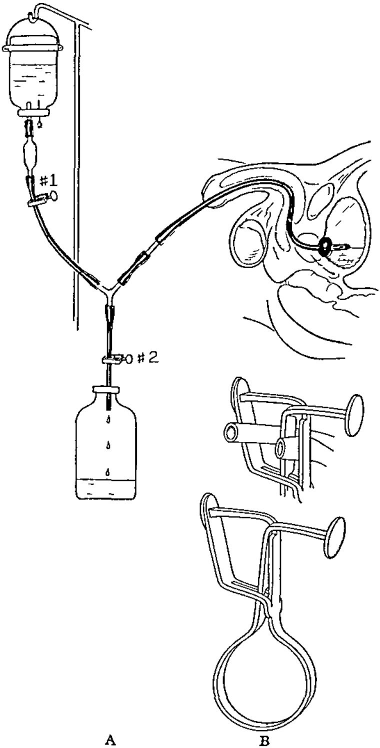

Fig 2 A, Closed drainage B, Baumrucker clamp—a spring clamp designed to replace screw clamps 1 and 2 shown in Figure 2 A

container may be opened The fluid can be allowed to run into the bladder in whatever amount desired One can irrigate the cavity, such as the bladder, and also distend the folds of the wall of the cavity Unless otherwise specified, normal saline solution would be used for this irrigation Boric

fluids during the period of dulled sensorium Sometimes this is necessary because the patient is in shock, but many times the fluid could be run in more slowly or its administration even delayed until the patient is more awake A fully conscious patient may be unable to initiate the act of urination when his bladder has become overdistended during the time of dulled sensorium

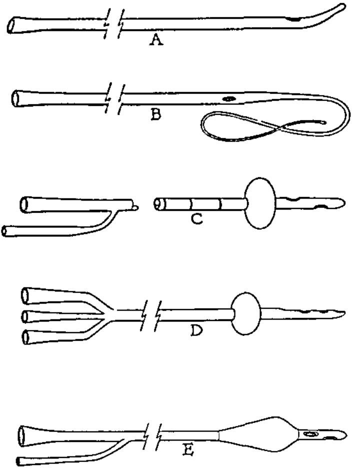

Fig 4 Types of catheters, A, Coude tip Tieman catheter, B, Phillips catheter C, Foley bag catheter, D, Foley-Alcock catheter, E, Foley with 75 cc fluted bag

The practice of writing an order for the catheterization of the patient every eight hours, if he is unable to void, is only to be condemned It represents a lazy attitude in the practice of medicine If the patient is unable to void, the situation should be appraised How much fluid has the patient had? What is the size of the bladder as determined by percussion and palpation? Is the patient, at the time of needing to urinate, able to stand at the bedside with the aid of nurses and attendants? If it is decided that the patient has a distended bladder and is unable to urinate, then he should be

placed under him It is necessary to maintain the height of the syphon arm in its exact relation to the level of the bladder Tidal drainage was primarily designed for patients requiring long-term drainage, such as those with spinal cord injury

Catheters or drainage tubing must not act as dams, obstructing the outflow of urine Occasionally, the tubing will have to be irrigated just sufficiently to ascertain that it is open It might be obstructed with a blood clot, or the patient might be lying on it Even if there are no drainage tubes, one needs to be sure that the urinary passages are not obstructed The ureter may be blocked with a small chip of a calculus or a blood clot The bladder may be blocked with a blood clot Spasm of the bladder may obstruct the catheter by forcing mucosa against the eye of the catheter so that drainage is impossible One must be forever cognizant that urine must be produced and that it must have adequate means for exit It is for this reason that urologists as a group are always ready to put in tubes, catheters and Penrose drains

Urine which is formed but cannot get out will either break out or will exert back pressure on the kidneys A markedly overdistended bladder may be a factor in prolonging or even in producing a shocklike state Conversely, to drain the bladder too rapidly when urinary retention has been built up over a long period of time may produce a sudden lowering of intra-abdominal pressure and a sudden lowering of back pressure on the kidneys sufficient either to send the patient into shock or to produce bleeding from the kidneys When back pressure on the kidneys has reached a value equal to the filtration pressure, glomerular function will cease If this occurs in a patient with a solitary kidney, or bilaterally, the patient will develop a progressing degree of retention of nitrogenous waste products and will develop the clinical picture of uremia

Acute Urinary Retention

Acute urinary retention may be a frequent occurrence in an intensive treatment room It may follow trauma, surgery, coma, a mentally depressed state, or spinal anesthesia There are a number of contributing factors which should be borne in mind First, it should be remembered that a certain percentage of normal persons who are well will have a difficult time, and some may even find it impossible to urinate while lying down This is more true with men than it is with women If the patient may be raised, one should attempt to get the patient up, at least by the bedside, to void Often this will be less strenuous if done with help than will the gymnastics which must be done to get the patient to urinate while in bed Another factor is that all too often the patient receives a large volume of intravenous

patient should be able to carry on fairly soon, then one might consider intermittent catheterization on two or three occasions to be all right But, if it would appear that the procedure is going to have to be repeated more times than that, it would be better to place an inlying urethral catheter, such as a no 18 F Foley (Fig 4 C), and leave it indwelling from the beginning Especially is this true if the patient has given a history of difficult urination For example, if an elderly patient with a history of some hesitancy on urination, suggesting a slowly enlarging prostate, is unable to void following the setting of a broken hip, then one might be inclined to believe that he would be unable to void by himself, and an inlying catheter would be employed from the beginning

Acute Renal Failure

Acute renal failure may be initiated by one of three ways first, as an early part of acute nephritis, second, suddenly as complete anuria if stones block both ureters, or if a calculus blocks the active kidney when its opposite is nonfunctioning, either because it has been removed or because of severe disease like hydronephrosis, or if both ureters are ligated accidentally at surgery, and, third, "nonrenal" causes leading to renal suppression, such as poisoning due to phosphorus, mercury, lead or turpentine, incompatible blood transfusions, the presence of sulfanilamide crystals, aortic thromboses involving the renal arteries, or, reflexly, as after severe injury, operation or even the passage of a catheter

In anuria, one should consider the possibility of bilateral ureteral obstruction (or unilateral obstruction in a solitary kidney) If there is any doubt, at least one ureter can be gently calibrated to check for obstruction

As a result of a very large volume of literature appearing since World War II, many people associate acute renal failure with extrarenal azotemia, hemoglobin nephrosis, lower nephron nephrosis and many other conditions which were spoken of as though each were a complete and separate entity Acute renal failure is now pictured as a progressive clinical state with many facets, some of which may be reversible and some irreversible It is a complication of intravascular hemolytic reactions, crushing injuries, burns, nontraumatic muscular ischemia, sulfanilamide intoxication, or toxemia of pregnancy The patient develops oliguria and/or anuria, heme pigment deposition and excretion, hypertension and uremia Initiating factors may be the destruction of tissue, destruction of blood, development of shock, and the loss of fluid and electrolytes due to vomiting or diarrhea The renal lesion is one of focal degeneration and necrosis of the epithelium of the distal tubules, with brown casts in the lower nephron and collecting tubules

Acute renal failure (to include lower nephron nephrosis, transfusion

catheterized For the female patient, most any kind of catheter is usable, but a hard rubber, whistle-tipped catheter will be found the easiest to use On the other hand, with the male patient, success will be obtained most often and the patient will be less traumatized if a no 18 F Coude-tip Tieman catheter is used (Fig 4 A) This will be able to make the curve from the pendulous urethra into the prostatic urethra with greater ease than will a catheter of other type Prior to catheterization, about 5 cc of a water-soluble lubricant, such as K-Y jelly or Lubifax, should be injected gently into the urethra with a 10-cc syringe One should specifically not use an oil, such as sterile mineral oil, in this manner, because the veins of the penis have very fragile walls, and, if some material gets into the vein, an oil embolus may be produced There is no danger if a water-soluble lubricant is injected very gently If it seems that the catheter is in the bladder, but the anticipated copious flow of urine is not obtained, about 5 cc of sterile saline or water are injected with a syringe through the catheter Frequently, in dipping the catheter into the lubricant prior to catheterization, or in pushing the catheter through the urethra which has had a lubricant injected into it, a plug of lubricant has obstructed the eye of the catheter As soon as this plug has been dislodged, the urine pours forth

Following catheterization, it is not necessary to inject silver salts or similar material into the bladder If catheterization has been done under careful aseptic technique, the risk of infection is not great On the other hand, if there is danger of infection, owing to the field being markedly contaminated, or, if it is expected that the patient will be catheterized more than once, it is preferable to give small doses of a very soluble sulfa drug, such as Gantrisin, by mouth, 0 5 gm four times daily, as a prophylaxis

The question arises as to how often intermittent catheterization should be performed Sometimes it is better to catheterize early rather than to let the patient go too long and strain several times in an attempt to urinate A careful appraisal should be made each time The procedure should not be repeated routinely at such-and-such an hour In addition, an appraisal of the situation should be made the very first time that the procedure is done so as to ascertain to some degree whether or not the patient will be able to urinate by himself from then on If it is suspected that he might not be able to urinate, the question of how soon it can be made easier for him to do so by such devices as getting him up is considered Involved in the appraisal of the length of time before the patient would be able to urinate unaided, the severity of the operation must be taken into account and whether or not the patient is going to be completely bedfast Is the patient in a body cast and unable to help himself at all? Is he going to be in a coma, following some neurosurgical procedure, for a prolonged period of time? If the

Given a patient with trauma, hemorrhage, water and mineral depletion due to vomiting or diarrhea, intravascular hemolysis, or exposure to nephrotoxic chemical, one must have a day-to-day record of urinary volume If truly impressed with its importance, it can be accurately determined even if the patient is incontinent, delirious or the bladder is being frequently irrigated

As more knowledge has led to the recognition that there is an actual organic lesion present, namely, patchy areas of renal tubular destruction, the medical profession has virtually abandoned such procedures as renal denervation, renal decapsulation and the use of diuretic agents These will usually produce much harm, if nothing else, by adding stress to the patient's already strained state

If one gives fluids in excess of the amount being lost, these fluids will accumulate in the body, especially in the intracellular compartment The patient will become overloaded, and the tissues will be edematous If the lungs become edematous, the patient may literally drown in his own fluids

One of the major causes of death is cardiac failure, and, if careful appraisal is made, this failure often is found to follow the administration of water, sodium and blood in amounts greater than those recommended

The anemia that is frequently present may lead one to give a blood transfusion quickly Not infrequently, when the anemia has become moderately severe with a hematocrit reading of 20 to 25, its progression slows down or may stop, even though the oliguria persists To correct the anemia with transfusions usually requires large amounts of blood Since pulmonary congestion is such a frequent accompaniment of a transfusion, and, since these patients seem to tolerate a severe anemia surprisingly well, it would seem to be good judgment to examine very carefully any reason for giving transfusions during oliguria and early diuretic phase

There are patients on record who have recovered after having a combination of oliguria and anuria for twenty-one days The patient with oliguria and anuria requires judicious handling The average one will either get worse or begin to improve by the tenth to the fourteenth day In maintaining water and electrolytes as near normal as possible, treatment is dictated by the chemical and physiological abnormalities present at the moment One must calculate water loss on the basis of sensible loss and insensible loss The sensible loss will include fluids in the urine, vomitus, exudates and transudates The insensible loss will include fluids lost through the lungs and skin In the absence of fever, approximately 400 cc of water are lost each day in the lungs and approximately 600 cc through the skin If there is moderate fever or sweating, this total will be increased by 500 cc per day, and to replace the salt in the perspiration, the fluids

kidney, burn nephritis, hepatorenal syndrome and many others) results when renal excretory function is rapidly (and sometimes temporarily) lost because of a combination of changes in renal circulation, and degeneration of areas of renal tubular epithelium In many cases, more than one etiological cause may be a contributor One instance, which has been reported at great length in recent urological literature, is that seen following transurethral prostatic resection in which plain distilled water has been used as an irrigating fluid With the relatively negative intravenous pressure in the veins of the prostatic plexus, water is forced into these by virture of the head of pressure used in the irrigating system In this situation, the hypotonic solution produces a hemolysis To test for it, one may draw 5 cc of blood into a dry syringe to check for the degree of hemolysis This free hemoglobin may be precipitated in the tubules to produce damage to the tubular epithelium The clinical course will depend upon the cause or causes, the severity of each, the patient's response to each, the duration of the effect, and the speed of initiating early therapy In the typical case, oliguria will develop, possibly anuria, oliguria again, followed by some diuresis This may take from seven to twenty-one days

In the typical case, awareness of the developing renal failure may be lost because of concern with the associated lesion If careful intake and output record is being kept, one will be aware of the developing oliguria The urinary output must be measured exactly Often, this may be best achieved by employing an inlying catheter so that all urine may be collected The blood chemistry values must be determined almost daily, including Sunday During this phase, overadministration of salt and water must be avoided The patient must receive fluids to balance the fluid output (urine, vomiting, sweat, moisture in exhaled air, and drainage from any fistula) exactly The patient may develop lethargy and nausea Vomiting and diarrhea may begin Pulmonary edema and potassium intoxication may develop A careful check on the milliequivalent values of blood sodium, potassium, chlorides and carbon dioxide combining power must be kept If the patient is going to get well, there will be a successive increase in daily urine volume In the diuretic phase, water and inorganic ions may be lost excessively in the urine, so that care must be taken to keep up with replacement as needed Nowhere in medicine must one be as accurate in following the daily urine volumes and blood chemistry values as in this clinical condition Each day's prescribed fluids and their electrolytic content must be carefully calculated on the basis of the fluid and electrolyte loss Many deaths are the result of medical mismanagement The patient must be treated diligently, for reversal of the clinical state may occur at any time, even though his condition may appear hopeless

the condition which causes the obstruction is usually a slowly developing one The obstruction most usually seen is that due to benign prostatic hypertrophy, although other conditions which may lead to obstruction below the ureteral orifices may produce sufficient back pressure on the kidneys to interfere with the work of the kidneys to a degree sufficient to produce uremia Thus, a bladder tumor of the trigone area may be a cause, as might be a severe urethral stricture This latter may be a congenital stricture of the bladder neck as seen in children On the other hand, if the patient has only one kidney, the obstruction may be above the level of the ureteral orifice, because the lesion in such a patient has only to obstruct one kidney A slowly developing uremia may allow the patient to adjust to it, and the patient may enter the hospital perfectly rational with a relatively high amount of nonprotein nitrogen in the blood On the other hand, if the patient has only one kidney and this suddenly becomes obstructed with a ureteral calculus, the patient may be in semicoma with a relatively low amount of nonprotein nitrogen in his blood stream No matter what the cause, the effect of the obstruction must be relieved (although at the time one may not need to remove the obstruction, but simply short-circuit around it) and the kidneys be allowed to do their work of removing the nitrogenous waste products from the body The essential feature is the establishment of urinary drainage

In a patient with a solitary kidney with ureteral blockage, the stone might well be removed at once The correction of the primary fault would be as simple as any other means of establishing good drainage

In a patient having a bilateral lower ureteral ligation during a recent operation of the pelvic region (such as hysterectomy), one might consider reopening the abdomen to de-ligate the ureters On the other hand, if the patient was not a good risk, it would be better to perform a nephrostomy quickly The patient could be allowed to recover from the first procedure, and in about a week or ten days the surgeon might seek to restore the continuity of the ureteral channel The one functioning nephrostomy opening would be sufficient to keep the patient out of uremia If the primary pathological condition is below the ureteral orifices, one might elect to establish urinary drainage either by the placement of an inlying urethral catheter or by performing a suprapubic cystotomy (maybe even a trocar cystotomy) quickly The cystotomy is usually more reliable in producing urinary drainage and in relieving the uremic state It is for this reason that the two-stage suprapubic prostatectomy was usually a very successful and very conservative way of handling obstruction due to enlarged prostate After the blood nonprotein nitrogen value has returned to normal, a primary corrective procedure, such as the removal of the hypertrophied prostate, can be car-

given should contain 50 milliequivalents of sodium and 50 milliequivalents of chloride If sweating is of sufficient degree to require changing the patient's sheets and pajamas, an additional 500 cc of solution which would contain an additional 25 milliequivalents of sodium and 25 milliequivalents of chloride should be given The use of 10 or 50 per cent glucose will add more calories and cut down on protein catabolism, but may precipitate pulmonary edema, and heart failure Digitalis may be needed to treat the heart-failure

By and large, with careful management and with early recognition, one should be able to prevent hyperpotassemia However, if it does occur, it can be treated by one of three methods First, dialysis may be obtained by the use of the artificial kidney This effect will last several days This is the ideal situation for the use of the artificial kidney, but this instrument is not generally available Second, cation exchange resins may be employed in doses of 15 gm , given three times a day in either water or fruit juice This, of course, requires that the patient be able to retain fluids and food taken orally, which is often not the case Third, a combination of glucose and crystalline zinc insulin may be administered This is made up as a 25 per cent solution with one unit of insulin for each 2 gm of glucose One hundred to 200 cc of this mixture may be given as often as clinical, chemical and electrocardiographic indications warrant it In addition, 25- to 50-mg doses of testosterone propionate may be given daily The glucose-insulin-testosterone effect is measured in hours

About 25 per cent of deaths occur after the diuretic phase has started Consequently, when patients begin to improve, they must be followed just as carefully as during the oliguric phase Fluid and electrolyte losses will be increased as the result of increased amounts of urine, but these losses must be replaced as they are occurring During this period, hypopotassemia may develop Careful administration of fluids, one of which should be Ringer's solution, will furnish some potassium In some patients, however, the urinary output may reach 5000 cc or more daily In such a patient, the blood potassium levels should be watched very carefully Usually, by this time, the patient is able to eat, and, thus, will be able to obtain potassium from either food or oral medication This is much to be preferred, for, with the intravenous administration of potassium, potassium intoxication may easily and quickly be produced

Uremia

There are several causes of uremia, but, in this section, we shall deal with that most commonly seen by the urologist, namely, that due to urinary obstruction Frequently, this is a slowly developing clinical state because

This same separation of peritoneum from retroperitoneal structures may so disturb the innervation of the intestinal tract that the patient will have cessation of intestinal peristalsis for twenty-four to forty-eight hours Many urologists will put a Levin tube into the stomach and connect it to continuous suction for this period This is not really necessary, but one should be cognizant of the situation Some urologists may use small doses of neostigmine methylsulfate (0 5 to 1 cc of 1 2000 solution) or Urecholine (2 5 mg) given subcutaneously Oral intake should not be started until signs of peristalsis by abdominal auscultation are detected

In addition to the above-mentioned problems, a third one may be present if the renal surgery required any cutting of the renal parenchyma The kidney is a very vascular parenchymal organ, the tissues of which are not very elastic It does not contract much to aid in hemostasis, thus, any dissolution of the kidney substance, be it due to a tear or incision, may bleed One must watch a kidney subjected to this type of damage very carefully until healing is assured

Nephrectomy

A simple nephrectomy should cause very little trouble postoperatively Present-day surgeons seldom close an incision with clamps still on the renal pedicle, to be removed several days later Today, many urologists are doing individual vessel ligation rather than mass pedicle ligation This reduces still further any possibility of postoperative hemorrhage Usually, these patients are out of bed on the second day and discharged from the hospital within seven to nine days

Nephrostomy

Some surgeons do not like nephrostomies, but will do pyelotomies The reason for this is that sometimes a nephrostomy tube, as it lies in the renal parenchyma, may erode into one of the arcuate or interlobar arteries to produce a severe hemorrhage This is not a frequent occurrence The chances for such will depend upon how long and for what reason the tube is inserted in the first place In using mushroom catheters, one may tear the cortex as the wide mushroom is pulled through it in removing the catheter For this reason, many surgeons now use a small balloon-type Foley catheter having a stub-nose, beyond the Foley bag Thus, when the bag is deflated, it is very simple for the catheter to slip out In managing the nephrostomy tube, one needs to be certain that its lumen is not plugged with a blood clot The tube should be very gently irrigated a couple of times a day with 3 to 4 cc of normal saline solution If the tube remains in place for more than ten days, it would be wise to use Suby s solution

ried out In some patients in whom the uremic state had slowly progressed over a long period of time, it may be necessary to maintain drainage for a longer period of time than is usual This allows drainage through a suprapubic cystotomy opening for two or three months before electing to correct the obstruction In some patients, the nonprotein nitrogen value will not return completely to normal, but the patient will establish what will be for him a new normal As is well known, the normal nonprotein nitrogen value is from 25 to 35 mg per 100 cc of blood Some individuals will never regain this level, for the kidney damage is too permanent In such patients, the physician may have to be satisfied with obtaining a new normal of 60 to 65 mg per 100 cc One can determine if this is to be the patient's new normal if consistently, over a period of several weeks, the nonprotein nitrogen value stays at this new level Much more frequently is seen, however, the clinical condition in which the kidneys return to normal function within ten days to two weeks It is for this reason that a simple inlying urethral catheter frequently will establish sufficient drainage to allow the kidneys to perform their function During this period, sufficient fluids *should be furnished to the kidneys to aid them in their work* Many times, these patients have acquired a habit of not drinking much fluid because of the obstruction that is present They seem to know that, if they do not drink much, they do not have to work to get the urine past the obstruction, and, so, voluntarily, cut down on their fluid intake However, with the urinary drainage established, these patients at the very minimum must be made to drink what should be a normal amount of fluid, and should be encouraged to drink even more This allows the kidneys to "wash out" the nitrogenous backload

RENAL SURGERY

In all renal surgery, the surgeon must separate a large area of loose areolar fatty tissue when the peritoneum is separated from the retroperitoneal structures Very little ligation is done, because very few arteries are opened, however, there will be a variable amount of venous oozing Most urologists will leave Penrose drains in place, in order to prevent the formation of a hematoma Postoperatively, the dressings may become soaked frequently during the first twenty-four to forty-eight hours They will need to be changed or reinforced To the person more familiar with clean abdominal surgery, this may seem like a lot of bleeding If it appears to be too much, one should watch the blood pressure reading and pulse rate carefully and should obtain repeated blood counts Most usually, the appearance is suggestive of more profuse bleeding than is actually taking place

ureter There is much variation in the postoperative course of these patients Some surgeons do not employ splints in these procedures, while some urologists use splints for a variable period of time—formerly, up to three to six weeks, but in recent years the tendency has been to remove the splints in a shorter period of time Formerly, the splints used were simple ureteral catheters, but, with the development of the nonreacting plastic catheters, more surgeons use such instruments as polyethylene catheters and tubing for splints This reduces the tendency to cause formation of urinary salts, which in times past have precipitated out to form the nidus of a stone When a splint is used, one end is brought out through a nephrostomy opening This same nephrostomy opening will have a nephrostomy tube The usual procedure is to pull out the splint when it is deemed necessary and leave the nephrostomy tube in place for a few days longer During this interval, one can irrigate the pelvis with Suby's solution "G," in order to wash out any small sandlike sediment This irrigation can be done several times a day, keeping in mind that the usual pelvic capacity is 4 to 5 cc at any one time Most of the fluid will probably go down the ureter, and therefore one should not expect to be able to aspirate back as much as one injects

Ureterosigmoid Implant

In the immediate postoperative period, the physician needs to be on the lookout for leakage of urine at the site of the ureterosigmoid anastomosis with resulting peritonitis, or for electrolyte changes, the most common of which is a derangement of the blood chlorides and the blood carbon dioxide combining power Peritonitis is not easily recognized because it will be masked in many instances by the antibiotics which the patient may already be receiving Consequently, one must watch for any sign of distention, lack of bowel sounds on auscultation, nausea, vomiting and any persistent low-grade fever If these signs persist, one should seriously consider whether or not it will be necessary to re-open the incision to look at the anastomotic site Leakage of urine with resultant peritonitis is not seen in present-day surgery as often as it was in previous years Surgical technique has developed to the point where the ureter is more securely attached to the bowel at the site of the implantation On the other hand, the derangement in blood chemistry is frequently seen and must be watched for very carefully One should order blood sodium, potassium, chlorides, carbon dioxide combining power and nonprotein nitrogen determinations at almost every-other-day intervals This close supervision of the blood electrolytes will allow one to be forewarned as soon as any evidence is produced indicating that a change is taking place The most common derangement is an

"G" as irrigating fluid This dissolves the encrusting urinary salts One should make very certain that the nephrostomy tube is securely anchored in place so that there is no drag on the kidney tissue inside the body In anchoring the tube, great care should be exercised not to so sharply angulate it that it does not drain well

Heminephrectomy

What has been said regarding renal surgery in general and nephrostomy in particular will hold true here with one addition The patient may bleed postoperatively from the sutured cut surface of the kidney where it was divided from the portion that was removed These patients should be watched very carefully for postoperative hemorrhage

URETERAL SURGERY

In the immediate postoperative period following all ureteral surgery, the patient may have a more or less profuse drainage of urine from the incision in the ureter out along the course of the Penrose drain This need not be alarming at first, unless, of course, it occurs in a patient in whom the ureter was unknowingly involved in the surgical procedure If the latter accident occurs, one must be concerned as to whether or not the lower ureter has been completely severed from the upper, and, also, whether or not the lower ureter was ligated so as to be permanently obstructed It may be wise to pass a ureteral catheter up from below to see that the ureter is intact

Ureterotomy

A simple incision of the ureter made for the removal of a calculus may drain urine profusely for several days postoperatively The Penrose drain should be left in place for about five to seven days, or longer, if drainage is still profuse If drainage persists after the Penrose drain has been removed, one must investigate the possibilities of lower ureteral obstruction, such as that due to a stone fragment having dropped lower in the ureter or the ureter having been angulated at surgery In order to reduce the possibility of the ureter being too sharply angulated, many surgeons will insert a ureteral catheter as a splint When this is done, in a simple ureterotomy, it can be removed in twenty-four to thirty-six hours If the splint was put in from above with one end pushed down into the bladder where it has been allowed to coil up, the removal of the catheter will need to be done with the aid of the cystoscope, grasping forceps being employed

Ureteral Plastic Procedures

These may vary from ureteropelvic plastic repairs to repair of a severed

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elevation in the blood chlorides which can be corrected very easily by giving the patient sodium bicarbonate tablets by mouth

A rectal tube with several extra holes should be kept in place constantly from the time of surgery for several days thereafter, and the urinary output through the rectum should be measured accurately It may be necessary to irrigate the rectal tube occasionally with a few cubic centimeters of normal saline solution, in order to dislodge any small piece of feces that may be blocking the tube One does not want the rectum to become distended at any time during the first few days, because of the danger of blowing out through the anastomotic site The rectal tube will aid in deflating the rectum of its urine and gaseous contents

It is frequently possible to begin feeding these patients by the second day following operation, although many surgeons feel that this will result in plugging of the rectal tube, and these men prefer intravenous feedings for about four days The diet should be one of a very low residue, with high protein content

One complication which has been observed by the author has been the development of intestinal obstruction due to a small piece of ileum becoming caught between the juncture of the ureter and the bowel At the time of surgery, it is necessary to make certain that the peritoneum is closed over this area so that there is no ring of space between the ureter, the sacrum and the bowel wall through which a small piece of ileum can herniate When such herniation does occur, it is frequently masked for several days owing to the antibiotic therapy At the slightest sign of abdominal distention, one should insert a Levin tube into the stomach and attach it to gastric suction apparatus But more important still, at the slightest sign of distention, the patient should be watched carefully in order to ascertain the cause of the distention, for correction may be needed without undue delay

BLADDER SURGERY

The postoperative care of the bladder involves three aspects, regardless of whether the operation has been performed on a traumatized bladder or is an elective procedure First, one must consider hemorrhage This will usually be avoided by having done careful surgery Sometimes there will be postoperative hemorrhage Second, urinary extravasation must be watched for carefully Urine is very toxic It will naturally leak through an opening in the bladder, but this is not too serious if there is ready exit to the outside of the body It is for this reason that urologists use Penrose drains and catheters freely Third, is the problem of bladder spasm This complication cannot be predicted and its care may be difficult It may be

due to reaction against an inlying catheter or an infected bladder, or a bladder that has been handled with forceps too much and too roughly The usual medication used in the treatment contains narcotics plus belladonna derivatives One prescription that has been used to aid in the control of bladder spasm is the following

℞

Potassium Bromide	80 gm
Potassium Citrate	80 gm
Tincture of Hyoscyamus	80 cc
Paregoric	120 cc
Elixir Sabal and Sandalwood, q s	500 cc.

Sig A teaspoonful every four hours

Other urologists use subcutaneous injections of 1/75 or 1/100 grain of atropine Sometimes the catheter must be removed more quickly than would be otherwise planned

Repair of Ruptured or Torn Bladder

The postoperative course following this operation is usually uneventful Hemorrhage has been controlled at surgery and extravasated urine will have been drained away The patient will frequently be in less shock after surgery than before

Segmental Resection

For this operation, also, the postoperative course is usually uneventful The main trouble that might occur would be the accidental removal of the suprapubic tube while the patient is recovering from the anesthesia However, this is usually prevented by various means For example, the catheter may be sutured to the skin, or it may be taped carefully to the skin with adhesive close to the entrance into the incision In addition to either of these measures, some urologists employ a tight binder and pin the catheter to the binder To prevent the weight of the tube from pulling on the catheter, the tube is pinned to the bed with some slack lying on the bed to allow the patient some freedom of motion

Fulguration of Bladder Tumor

This procedure may be attended with a more troublesome postoperative course than any other bladder operation The fulguration itself may so irritate the bladder wall that the added irritation of the catheter may lead to paroxysms of bladder spasms These can be severely painful, necessitating the use of large amounts of narcotics

Bladder spasms, movement of the catheter, and/or partial separation of

elevation in the blood chlorides which can be corrected very easily by giving the patient sodium bicarbonate tablets by mouth

A rectal tube with several extra holes should be kept in place constantly from the time of surgery for several days thereafter, and the urinary output through the rectum should be measured accurately It may be necessary to irrigate the rectal tube occasionally with a few cubic centimeters of normal saline solution, in order to dislodge any small piece of feces that may be blocking the tube One does not want the rectum to become distended at any time during the first few days, because of the danger of blowing out through the anastomotic site The rectal tube will aid in deflating the rectum of its urine and gaseous contents

It is frequently possible to begin feeding these patients by the second day following operation, although many surgeons feel that this will result in plugging of the rectal tube, and these men prefer intravenous feedings for about four days The diet should be one of a very low residue, with high protein content

One complication which has been observed by the author has been the development of intestinal obstruction due to a small piece of ileum becoming caught between the juncture of the ureter and the bowel At the time of surgery, it is necessary to make certain that the peritoneum is closed over this area so that there is no ring of space between the ureter, the sacrum and the bowel wall through which a small piece of ileum can herniate When such herniation does occur, it is frequently masked for several days owing to the antibiotic therapy At the slightest sign of abdominal distention, one should insert a Levin tube into the stomach and attach it to gastric suction apparatus But more important still, at the slightest sign of distention, the patient should be watched carefully in order to ascertain the cause of the distention, for correction may be needed without undue delay

BLADDER SURGERY

The postoperative care of the bladder involves three aspects, regardless of whether the operation has been performed on a traumatized bladder or is an elective procedure First, one must consider hemorrhage This will usually be avoided by having done careful surgery Sometimes there will be postoperative hemorrhage Second, urinary extravasation must be watched for carefully Urine is very toxic It will naturally leak through an opening in the bladder, but this is not too serious if there is ready exit to the outside of the body It is for this reason that urologists use Penrose drains and catheters freely Third, is the problem of bladder spasm This complication cannot be predicted and its care may be difficult It may be

will be in trouble First of all, he will lose too much blood and may even be thrown into shock Secondly, the blood will clot in the bladder This will block the catheter and in turn will prevent the exit of urine The bladder may become very distended with urine and clots This will be more true following transurethral resection, in which no incision is made into the bladder to serve as a safety valve, than following other methods of surgery The bladder distention will augment the production of shock Thirdly, the

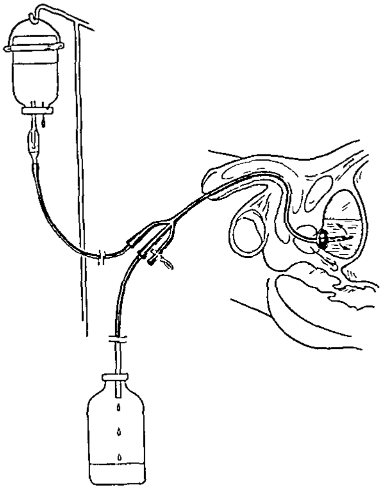

Fig 5 Continuous irrigation

bleeding and formation of clots in the prostatic bed will produce distention and aggravate the bleeding by stretching the raw area The control of bleeding is expected mainly from the knowledge that usually the prostatic bed will contract to obliterate the dead space, thereby closing off the small vessels

It is because of the bleeding that many surgeons establish, by means of urethral catheters and/or cystotomy tubes, a continuous irrigation system (Fig 5), employing normal saline solution as an irrigating fluid The irri-

slough may cause severe hemorrhage The charred tissue may separate from the bladder wall completely in an area where endarteritis has failed, or has not had time, to close off the blood vessel, resulting in hemorrhage If the bleeding vessel is small, effective treatment may be secured by setting up a continuous irrigation through the catheter, using normal saline solution The dilution of the blood will break up the clotting mechanism and thus prevent the bladder from filling with clots

Total Cystectomy

Some surgeons do a ureteral diversion of the urinary stream and a total cystectomy as a combined procedure in one stage Many, however, perform the ureteral diversion as a preliminary procedure and remove the bladder at a second operation The postoperative care following ureteral diversion is the same as that described earlier in this chapter for Ureterosigmoid Implant

The postoperative course of a patient having had a total cystectomy is relatively uneventful The procedure by and large can be carried out extraperitoneally Since bleeding should be easily controlled at the time of surgery, postoperative hemorrhage is a rare complication Naturally, there is a large space, previously occupied by the bladder, into which serum may ooze and which may become infected, or from which satisfactory drainage may not be secured Penrose drains should be retained in this space for quite some time and should be removed slowly so that the cavity can fill in from the bottom outward Also, this drainage will prevent exudate due to any infection of the serum occupying the dead space from being trapped Following total cystectomy, when the ureteral urinary diversion has been carried out as a previous procedure and therefore does not represent a problem at the time of the actual removal of the bladder, the patient should be able to get out of bed on the first postoperative day

PROSTATIC SURGERY

Surgical correction of urinary obstruction is one of the main problems in the older male patient This patient is in an age range in which heart trouble and arteriosclerosis are most common Special care taken in preparing such a patient for surgery will be amply repaid in a smoother postoperative course

No matter what type of surgery is elected (transurethral resection, suprapubic prostatectomy, retropubic prostatectomy, or perineal prostatectomy), the main postoperative problem is hemorrhage Even under the best of circumstances, there will be continuous oozing from the venous channels of the prostatic bed If arterial bleeding is not well controlled, the patient

would normally shrink and collapse It is for this reason that one of the prime requisites is to keep clots from forming, and, when formed, to remove them

It is, of course, a surgeon's desire to return these patients to the intensive therapy room with as minimal amount of bleeding as possible The difference between desire and reality may, on occasions, be considerable Many factors may contribute in causing a fulgurated area to break off before endarteritis has closed the blood vessel

How does one handle a patient in the postoperative period following transurethral resection? First, some resectionists do not put in any catheter at all, but allow their patients to urinate normally These surgeons are not too numerous, and are in the main located in centers where well-trained personnel are in constant attendance

Second, one may, if the patient bleeds, put in a Foley bag catheter and then irrigate the bladder with normal saline solution at periodic intervals Most resectionists return their patients from the operating room with this type of catheter in place

If bleeding becomes brisker and clots are plugging the catheter, a third step might be the changing of the catheter to a double-lumen Foley bag catheter, after first cleaning out all of the clots with a metal catheter With the double-lumen catheter, continuous irrigation (Fig 5) of the bladder with normal saline solution can be carried out This will interfere with the clotting mechanism and thereby prevent clots from being formed to plug the catheter

If it is felt that bleeding is mostly venous instead of arterial, the method of control would be to insert a 75- or 100-cc bag (pear-shaped) catheter (Fig 4 E), after first removing all clots The bag could be filled, or partially so, depending upon how much prostatic tissue was removed and how large the prostatic cavity would be estimated to be The catheter would then be drawn into the prostatic bed to tamponade the prostatic lobe to control the low-pressure type of venous bleeding Continuous traction can be kept on this catheter by taping it to the leg, or else by having it connected to a weight hanging over a pulley at the end of the bed

If all of these methods fail to control bleeding, the patient should be returned to the operating room where the resectoscope should be re-introduced with the intention of fulgurating the bleeding point However, after the resectoscope sheath has been introduced, and all of the clots have been carefully evacuated so that the wall can be examined for bleeders, it is frequently found that no bleeding points are visible It is felt that in these patients the distention produced by the clots had been responsible for the maintenance of active bleeding

Occasionally, bleeding will be so severe that all methods of control

gating solution, constantly going in and out of the bladder, will dilute the blood and prevent it from clotting by dilution, and will also wash out the diluted blood The statement has been made that the patient will lose as much blood in the immediate postoperative period following a transurethral resection as he will have lost during the surgical procedure

A problem formerly feared, but now almost completely ignored, is infection in the space of Retzius In former years, much was written about "walling off the space of Retzius" With modern antibiotics, this is given little consideration, although this space is still drained for twenty-four hours following either a suprapubic or retropubic prostatectomy

Transurethral Resection

This operation is performed for carcinoma of the prostate, benign prostatic hypertrophy, or a bladder tumor In this procedure the prostate or tumor is cut with an electric current passing through a small wire loop The pieces are removed through the sheath of the resectoscope employed for this operation The pieces must be removed carefully, for if so much as one "chip" remains it may block the eye of the catheter, which is left inlying in the bladder following operation, and produce acute urinary retention

At the time of prostatectomy, the bleeding point can be visually fulgurated It is thus possible to have the patient leave the operating room with no evidence of bleeding It must be remembered, however, that such fulguration has a charring effect Every effort should be made to fulgurate the exact point of bleeding, thereby keeping the area of charring so very small that grossly it is not even visible Although invisible, nevertheless the charred spot is still there and bleeding may be resumed if the crust is raked off by the catheter which is passed after the resectoscope has been removed

If the patient's blood pressure rises after surgery, small bleeding points may be be blown out, or ones not noted when the blood pressure was lower may become important Therefore, it is desirable to maintain a steady blood pressure

Bleeding may occur at any time up to six to eight weeks postoperatively It is, however, more common in the first twenty-four to forty-eight hours than at a later period It may be severe enough to require returning the patient to the operating room to re-fulgurate the area This may be done with the patient under intravenous Demerol or morphine anesthesia Sometimes no anesthesia is used One must be wary of a patient in masked shock, for intravenous Demerol or morphine may precipitate complete shock When the patient is in shock the bleeding points may not be visible Sometimes the bleeding can be controlled by simply washing out all of the clots that are distending the prostatic bed and/or bladder The distention, by maintaining stretch on the raw tissue, holds open blood vessels that

end of the bed All traction should be released in twelve to twenty-four hours to prevent too much pressure from being applied to the external sphincter

Retropubic Prostatectomy

The postoperative course following a retropubic prostatectomy is usually fairly uneventful The very nature of the operation allows one to control the bleeding point under visualization One of the main complications of a retropubic prostatectomy is osteitis pubis, but this usually does not develop during the first week of the postoperative period

Perineal Prostatectomy

Like the retropubic prostatectomy, the perineal prostatectomy is followed, as a rule, by a fairly smooth postoperative course Hemorrhage is very seldom encountered because it has been controlled under direct visualization at the time of surgery It is true that, like the retropubic prostatectomy, the perineal prostatectomy is a more tedious operation, and requires more time, than either a suprapubic or a transurethral resection of the prostate However, following neither the retropubic nor the perineal prostatectomy is the postoperative course anticipated to be very severe

SURGERY OF THE EXTERNAL GENITALIA

In the postoperative period, following surgery on the testicles, scrotum and penis, one may encounter two types of complications The first is hemorrhage into the soft tissues The tissues involved are rather loose, areolar in type and allow blood to extravasate fairly easily The tissues themselves do not exert any pressure upon the operative site, thereby to aid in the control of bleeding Thus, a very small amount of blood from a vein may extravasate and produce a large hematoma Careful watch should be kept for indications of bleeding during the first twenty-four hours postoperatively On some occasions, it may be necessary to return the patient to the operating room in order to ligate a small bleeding point The second complication that may occur is due to the tenderness of the tissues involved As a result of the handling, or of being too tightly taped with adhesive, edema of the scrotum or of the skin of the penis may be produced. The edema may be sufficient to compromise the urethra and, thus, produce urinary obstruction of some degree One should watch these patients very carefully for the first twenty-four to forty-eight hours following surgery to see that edema is not developing If it is, the main and only treatment is loosening of the bandage Fifty units of hyaluronidase may be injected into the edematous area

will fail When this occurs, a suprapubic incision will have to be made through which the prostatic bed is packed with a 5-yard roll of gauze For any patient in whom bleeding is anticipated, blood for replacement must be readily available Given a patient who is actually bleeding, 500 cc of blood must be typed and crossmatched to be kept tagged for the particular patient As soon as the intravenous infusion of this blood is started, another 500-cc amount must be typed and crossmatched, and tagged as a reserve

It is not often that bleeding occurs in a median bar formation, bladder neck contractures, or the small glands whose removal has involved the loss of only 15 gm of tissue

The catheter is usually removed on the second or third postoperative day, however, if at any time during the first week the patient develops fever, he should be immediately returned to catheter drainage for an additional twenty-four to forty-eight hours

The possibility of oliguria developing after a transurethral resection of the prostate should be borne in mind This condition will not occur, however, if isotonic fluids (glycine or Cytal) were used as irrigating fluids during the operative procedure, but it may occur if distilled water was employed The distilled water may enter the venous channels of the prostate where blood will be hemolyzed, releasing free hemoglobin into the blood stream The free hemoglobin itself, or in augmentation with some degree of shock, may produce damage to the tubules of the kidney This entity is seen less and less as more urologists are using isotonic, nonconductive solutions such as Cytal or glycine

Suprapubic Prostatectomy

This operation is usually performed for the treatment of benign prostatic hypertrophy and never for the cure of carcinoma, if the latter is suspected ahead of time, because the line of cleavage is ruined by the carcinomatous growth It is also the type in which bleeding is most poorly controlled The arterial bleeders can be ligated at the bladder neck, but not in the prostatic bed For this reason, most operators will put in some type of large bag that can be pulled down to tamponade the prostatic bed They may use a Pilcher bag or a 100-cc pear-shaped Foley bag catheter Gelfoam has been used around catheters and bags, and many surgeons do not hesitate to pack the prostatic bed with gauze packing, which is removed in thirty-six to seventy-two hours The Pilcher bag or the Foley catheter may be pulled down and taped to the leg so that constant pressure may be exerted upon the prostatic bed Sometimes the pressure is applied by hooking the catheter to a 1- or 2-pound weight hung over a pulley at the

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2 Soft diet
3 Demerol, 50 mg every four hours, p r n

Second Postoperative Day

1 Demerol, 50 mg every four hours, p r n

LIGATION OF A BLOOD VESSEL AT URETEROPELVIC JUNCTION

Postoperative Orders for the Day of Surgery

1 Morphine sulfate, 1/4 grain every four hours, p r n
2 Finish present bottle of blood being given intravenously
3 Give 1000 cc of 10 per cent glucose in water intravenously
4 Food and fluids by mouth as tolerated
5 Duracillin (a procaine penicillin), 300,000 units once daily
6 Reinforce dressing, p r n

First Postoperative Day

1 Give 1000 cc of 5 per cent glucose in saline solution intravenously
2 Regular diet
3 Morphine, 1/6 grain every four hours, p r n

Second Postoperative Day

Codeine, 1 grain, and aspirin, 10 grains, every four hours, p r n

NEPHROLITHOTOMY

Postoperative Orders for the Day of Surgery

1 Nothing by mouth
2 Give 1000 cc of 5 per cent glucose in water intravenously
3 Combiotic, 2 cc, intramuscularly, every twelve hours
4 Demerol, 75 mg every four hours, p r n

First Postoperative Day

1 Give 2000 cc of 5 per cent glucose in water with 500 mg of vitamin C and 3 cc of Solu-B dissolved in one of the bottles
2 Demerol, 75 mg every four hours, p r n
3 Regular diet

Second Postoperative Day

1 Give 1000 cc of 5 per cent glucose in water intravenously
2 Demerol, 50 mg every four hours, p r n

POSTOPERATIVE ORDERS

The following are some examples taken from charts of actual orders written for the patient on the day of surgery and for the first and second postoperative days

NEPHRECTOMY

Postoperative Orders for the Day of Surgery

1 Nothing by mouth for twelve hours, and then food and fluids as tolerated by the patient
2 Combiotic (a penicillin and streptomycin combination), 2 cc twice daily
3 Complete blood count and hematocrit determination, Stat
4 Demerol, 50 to 100 mg every four hours, p r n
5 Record intake and output accurately
6 Finish the present bottle of blood being given intravenously
7 Give 1500 cc of 10 per cent glucose in water intravenously

First Postoperative Day

Demerol, 75 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

PYELOPLASTY OF THE KIDNEY

Postoperative Orders for the Day of Surgery

1 Connect the catheter emerging from the flank to an open drainage tubing Do not irrigate, this will be done by the physician
2 Combiotic, 2 cc daily, intramuscularly
3 Demerol, 100 mg every four hours, p r n
4 Finish present bottle of blood being given intravenously
5 Give 2000 cc of 10 per cent glucose in water with 500 mg of vitamin C and 3 cc of Solu-B dissolved in one of the bottles
6 Complete blood count and hematocrit determination, Stat
7 Reinforce dressings, p r n
8 Record intake and output accurately

First Postoperative Day

1 Give 2000 cc of 10 per cent glucose in water intravenously and 1000 cc of 10 per cent glucose in saline intravenously

2 Rectal tube to be kept in place and connected to a drainage bottle
3 Measure fluid output through the rectal tube accurately
4 Demerol, 75 mg every four hours, p r n
5 Combiotic (a penicillin and streptomycin combination), 1 cc every twelve hours
6 Complete blood count and hematocrit determination, Stat.
7 Turn the patient and have him cough and breathe deeply every hour for twelve hours

First Postoperative Day

1 Give 1000 cc of 5 per cent glucose in water intravenously with 500 mg of vitamin C and 3 cc of Solu-B dissolved in one of the bottles
2 Demerol, 75 mg every four hours, p r n
3 Measure intake and output carefully

Second Postoperative Day

1 Blood chemistry studies to be ordered from the laboratory non-protein nitrogen, carbon dioxide combining power, chlorides, sodium, potassium, complete blood count and hematocrit determination
2 Demerol, 75 mg every four hours, p r n
3 Low residue diet
4 Sulfathalidine, 1 gm four times daily

TRANSURETHRAL RESECTION OF BLADDER TUMOR

Postoperative Orders for the Day of Surgery

1 Food and fluids to be given as tolerated
2 Demerol, 75 mg every four hours, p r n
3 Seconal, $1\frac{1}{2}$ grains at bedtime, p r n
4 Combiotic, 2 cc, intramuscularly, every twelve hours
5 Connect the urethral catheter to open drainage

First Postoperative Day

1 General diet
2 Demerol, 50 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

PYELOLITHOTOMY

Postoperative Orders for the Day of Surgery

1 Nothing by mouth for twelve hours, and then food and fluids as tolerated by the patient
2 Combiotic (a penicillin and streptomycin combination), 2 cc every twelve hours
3 Give 1000 cc of 5 per cent glucose in water with 3 cc of Solu-B and 500 mg of vitamin C
4 Demerol, 100 mg every four hours, p r n
5 Complete blood count and hematocrit determination, Stat

First Postoperative Day

1 Give 2000 cc of 5 per cent glucose in water with 500 mg of vitamin C and 3 cc of Solu-B
2 Demerol, 75 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

URETEROLITHOTOMY

Postoperative Orders for the Day of Surgery

1 Nothing by mouth for twelve hours, and then food and fluids to be added as tolerated
2 Demerol, 100 mg every four hours, p r n
3 Combiotic, 2 cc every twelve hours
4 Record intake and output carefully
5 Give 2000 cc of 10 per cent glucose in water, intravenously
6 Blood count (complete) and hematocrit determination, Stat
7 Reinforce dressings, p r n

First Postoperative Day

Demerol, 75 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

URETEROSIGMOID IMPLANT

Postoperative Orders for the Day of Surgery

1 Give 2000 cc of 10 per cent glucose in water with 500 mg of vitamin C and 5 cc of Solu-B

2 Rectal tube to be kept in place and connected to a drainage bottle
3 Measure fluid output through the rectal tube accurately
4 Demerol, 75 mg every four hours, p r n
5 Combiotic (a penicillin and streptomycin combination), 1 cc every twelve hours
6 Complete blood count and hematocrit determination, Stat.
7 Turn the patient and have him cough and breathe deeply every hour for twelve hours

First Postoperative Day

1 Give 1000 cc of 5 per cent glucose in water intravenously with 500 mg of vitamin C and 3 cc of Solu-B dissolved in one of the bottles
2 Demerol, 75 mg every four hours, p r n
3 Measure intake and output carefully

Second Postoperative Day

1 Blood chemistry studies to be ordered from the laboratory non-protein nitrogen, carbon dioxide combining power, chlorides, sodium, potassium, complete blood count and hematocrit determination
2 Demerol, 75 mg every four hours, p r n
3 Low residue diet
4 Sulfathalidine, 1 gm four times daily

TRANSURETHRAL RESECTION OF BLADDER TUMOR

Postoperative Orders for the Day of Surgery

1 Food and fluids to be given as tolerated
2 Demerol, 75 mg every four hours, p r n
3 Seconal, 1½ grains at bedtime, p r n
4 Combiotic, 2 cc , intramuscularly, every twelve hours
5 Connect the urethral catheter to open drainage

First Postoperative Day

1 General diet
2 Demerol, 50 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

SUPRAPUBIC PROSTATECTOMY

Postoperative Orders for the Day of Surgery

1 Give 2000 cc of 10 per cent glucose in water intravenously very slowly
2 Demerol, 75 mg every four hours, p r n
3 Combiotic, 2 cc every twelve hours
4 Connect suprapubic catheter to open drainage and connect the inlying catheter (urethral) to an irrigating bottle with a Murphy drip, and allow normal saline solution to run in at the rate of 40 drops per minute
5 Complete blood count and hematocrit determination, Stat
6 Sips of water by mouth post-nausea
7 Ephedrine, 5 mg , intravenously, at once, and 10 mg , intravenously, if pressure drops below 110 systolic
8 Apply traction to urethral catheter if bleeding is excessive

Orders Written Later on the Day of Surgery

5 Give 500 cc of blood intravenously, slowly
2 Measure intake and output carefully

First Postoperative Day

1 Soft diet
2 Demerol, 75 mg every four hours, p r n
3 Mineral oil, 1 ounce at bedtime
4 Nembutal, $1\frac{1}{2}$ grain at bedtime, p r n

Second Postoperative Day

1 Complete blood count and hematocrit determination
2 Regular diet
3 Patient may sit up

TRANSURETHRAL RESECTION OF PROSTATE

Postoperative Orders for the Day of Surgery

1 Closed drainage to be attached to the inlying urethral catheter and the bladder to be irrigated with 100 cc of normal saline solution every hour for four hours, and then four times a day
2 Duracillin, 400,000 units daily
3 Gantrisin, 1 gm four times a day
4 Demerol, 75 mg every four hours, p r n
5 Mineral oil, 1 ounce at bedtime

6 Food and fluids to be given orally as tolerated
7 Have blood drawn to check for hemolysis
8 Complete blood count and hemoglobin determination to be made in the morning

First Postoperative Day

Demerol, 50 mg every four hours, p r n

Second Postoperative Day

Demerol, 50 mg every four hours, p r n

RETROPUBIC PROSTATECTOMY

Postoperative Orders for the Day of Surgery

1 Water by mouth, post-nausea
2 Demerol, 75 mg every four hours, p r n
3 Give 1000 cc of 10 per cent glucose in water with 500 mg of vitamin C and 2 cc of Solu-B intravenously, very slowly
4 Combiotic, 2 cc, intramuscularly, every twelve hours
5 Turn the patient from side to side four times a day
6 Complete blood count and hematocrit determination to be made in the morning
7 Connect urethral catheter to closed drainage system and irrigate the bladder with 100 cc of normal saline solution four times a day
8 Record intake and output carefully

First Postoperative Day

1 Food and fluids to be given orally as tolerated
2 Demerol, 50 mg every four hours, p r n
3 Continue to measure intake and output carefully

Second Postoperative Day

1 Regular diet
2 Demerol, 50 mg every four hours, p r n
3 Push fluids

RADICAL LYMPH NODE DISSECTION AND ORCHIECTOMY

Postoperative Orders for the Day of Surgery

1 Fluid to be given by mouth as tolerated
2 Demerol, 100 mg every four hours, p r n for pain

3 Terramycin, 250 mg four times a day
4 Watch bandage in scrotal area to detect any swelling and/or edema

First Postoperative Day

1 Gantrisin, 1 gm four times a day
2 Turn patient every two hours from side to side
3 Regular diet

Second Postoperative Day

1 Get patient out of bed
2 Demerol, 50 mg four times a day

Chapter 14

PLASTIC SURGERY

ROBERT F STOKES, M D

PLASTIC SURGERY encompasses a broad field It deals with the correction of surface defects of the entire body and with injuries and congenital deformities of the hands and face

Providing intelligent and efficient care during the postoperative period requires a reasonable undertsanding of what was done in the operating room Frequently the details of this management are relegated to a resident, intern or nurse who was not a witness to the operation It is for this reason that occasional brief reference is made to operative techniques

GENERAL PROBLEMS

Preparation of the Patient for Surgery

GENERAL PHYSICAL CONDITION OF THE PATIENT It cannot be too strongly emphasized that attention must be given to the patient's general physical condition Failure to detect and correct malnutrition, dehydration, anemia, electrolyte imbalance, hypoproteinemia, or skin infections will cause an alarming increase in the number of postoperative complications and failures, and, in some instances, be responsible for the death of the patient

PREOPERATIVE SHAVING AND WASHING Cleanliness is a requisite for success in any type of surgery In nearly all patients, the operative field and adjacent areas should be shaved and washed with soap and water the night before the operation If the incision will come close to the hairline, or, if the hair will be included in the postoperative dressing, it should be washed *Eyebrows are never shaved*

Donor Sites When an extremity is to be used for a donor site, it should be shaved around its entire circumference If the thigh is to be used,

it should be shaved from the level of the inguinal region to 6 inches below the knee If the upper arm is to be used, shaving should include the axilla and the upper third of the forearm

Hands or Feet The nails should be clipped and cleaned The extremity should be shaved, washed with soap and water and wrapped in a sterile towel the night before the operation

Lips and Mouth If the operation is to be done in or around the mouth, the teeth should be cleaned This also applies when the patient is to receive a general anesthetic for any operation Usually dentures and removable bridges are taken out before the patient is sent to the operating room If, however, the operation is one in which the contour of the lips or mouth is a consideration, the dentures must accompany the patient to the operating room

PREANESTHETIC MEDICATION *Prior to Local Anesthesia* Local anesthetics are used on many of the plastic surgery patients They are not satisfactory for children or nervous adults A sedative is given the night before, and on the day of operation an average adult receives 3 grains of Nembutal two hours before the scheduled time of operation One-half hour before surgery he is given $\frac{1}{4}$ grain of morphine by hypodermic injection He is also given another $1\frac{1}{2}$ grains of Nembutal, if not unduly sleepy from the first dose

Prior to General Anesthesia When the services of an anesthesiologist are available the selection of the preanesthetic medication is left to him

The Operation

There are many excellent books of plastic surgery devoted to the technical details of operating One aspect of the subject cannot be emphasized too often This has to do with the importance of keeping the operating room as quiet and free from unnecessary noises and conversations as possible Patients are always apt to misunderstand or misinterpret remarks, especially while under the influence of the drugs used for their preanesthetic medication Teaching can be done in the operating room without resorting to lengthy recitations or question-and-answer techniques

Postoperative Management

DRESSINGS *Purpose of Dressings* Dressings play an important role in the proper treatment of wounds If the purpose of a dressing is not understood, its application is apt to be an unscientific ritual The *nature* (open, infected), *extent* (small, large, tendon or bone involvement) and *location* (hands, face, perineum) of the wound are points to consider in selecting a dressing A dressing is used for

1 *Protection* of the wound from external contamination and trauma A clean wound that has been closed without drainage is sealed by a coagulum which forms and dries within several hours and acts as a barrier to further bacterial invasion Wounds of the face and head which will not be subjected to additional trauma or irritation frequently need no dressings Those of the trunk and extremities may be subjected to friction from linens and clothing, and need the additional protection afforded by a dressing

2 *Absorption* of discharges that result from open or drained wounds Both wet and dry dressings are of value for this purpose The wet dressings favor the removal of wound secretions by preventing the wound exudate from drying on the surface and acting as a barrier to the further escape of exudate

3 A *vehicle for the application of therapeutic agents* (chemical or physical) to the wound and surrounding area Included in this group are the medicated dressings, the ointment dressings, the wet dressings and the hot wet dressings

4 *Compression* to minimize edema and capillary oozing A "pressure-type" dressing will produce mild compression which inhibits wound swelling and controls capillary oozing

5 *Splinting* and supporting the wound Immobilization is known to favor the healing of wounds, and is usually necessary when grafts have been applied in the neighborhood of joints, or when tendons have been sutured, or bones have been fractured

6 *Esthetic reasons* Most laymen are unfamiliar with any but the most trivial wounds Large wounds or irregular wounds should be covered with a dressing if the patient is to be seen by persons who, by their unfamiliarity with healing wounds, may portray revulsion at the sight of large or unusual wounds

Precautions during Dressing Changes There should be little doubt concerning the seriousness of wound infections or the responsibility the surgeon has in protecting clean wounds from contamination A person changing dressings on open wounds and wounds that might be open should wear a mask which covers the nose and mouth The patient should be masked, too, if there is the slightest chance that he might contaminate the wound by coughing or sneezing Wounds and inner dressings should only be touched with sterile instruments or sterile gloved hands

There is a real danger of infecting a clean wound if it is exposed to the air of a room in which dirty, infected wounds have recently been tended When it is not possible to have separate, well-ventilated dressing rooms and one room serves an entire ward or service, a well-arranged schedule for dressings will help reduce the possibility of cross infections The sched-

ule is so arranged that the clean wounds are dressed first, the smaller non-clean wounds are next cared for and the dressings of the larger dirty or infected wounds are changed at the end of the day As much time as possible is devoted to allowing the room to air between dressings Only the instruments and supplies to be used on the patient are exposed while he is in the room

Indications for Changing Dressings Common sense tells us that a dressing should be removed if it no longer serves a useful purpose, and, more important, that it should be removed if it is interfering with wound healing, or if it is obscuring changes in a wound that require prompt attention The advisability of continuing or altering treatment often depends upon the appearance of the wound and surrounding structures

There are several positive indications for removing the dressing and inspecting the wound These include pain, fever, change in appearance of the dressing and contamination of the dressing

Pain persisting in a wound for more than forty-eight hours or increasing after a period of relative relief should arouse a suspicion of the presence of infection Morphine or other sedatives should *not* be given to patients who have painful eyes or tight bandages until the cause of the pain has been investigated and corrected A patient's complaint of pain beneath a plaster cast cannot be ignored, it may be the only warning that an area of pressure necrosis is developing

The recrudescence of a fever suggests the possibility of wound infection

Fresh blood soaking through or coming from under a dressing requires investigation The appearance of pus or the presence of a foul odor is a positive indication for a dressing change

Dressings soaked with wound discharges or saliva, or contaminated with urine or feces should be removed and replaced

SUTURES Many interns and residents have difficulty in deciding when sutures should be removed A logical answer to the frequently asked question, "When should the sutures be taken out?" would be "When the wound has healed to a degree that sutures are no longer needed" That this is not a facetious remark can be appreciated if a little thought is given to some very fundamental concepts regarding sutures and wound healing

A suture has a single function, namely, to help hold the wound edges in apposition until the process of healing has advanced to the point where separation of wound edges is no longer likely

All wounds do not heal at the same rate There are many factors that influence this rate which vary not only with the type of tissue, but also with its location Skin, tendon and bone all heal differently Tissues which have

a similar structure will heal at different rates if they are from different parts of the body This is well demonstrated by comparing the rapid healing of the skin of the face or scalp with the rather slow healing seen in wounds that involve the skin of the back, the palms of the hands, or the soles of the feet

Surgical technique can influence wound healing Tissue trauma from rough handling, hematomas from inadequate hemostasis, dead spaces in the wound from improper apposition of tissues, and ischemia resulting from sutures under tension are all important factors in delaying wound healing

Bacteria and foreign bodies are among the recognized important causes of delayed wound healing Many constitutional factors have been revealed as contributing factors in prolonging the time required for wound healing These include chronic illness, vitamin deficiencies, dehydration, depletion of body proteins and anemia

In view of the above-stated facts, it must be obvious that the lapse of a specific period of time cannot be the only criterion for the removal of sutures The appearance of the wound provides information concerning the status of healing Separated wound edges, noticeable erythema or cyanosis, and the presence of more than slight edema or induration are all indications of delayed wound healing

If there is doubt as to the strength of the wound, one should exercise the precaution of removing only half of the sutures and observing the wound twenty-four hours later If, at the end of that time, there has been no tendency for the wound edges to separate, the remaining sutures are removed

SPECIFIC PROBLEMS

Skin Grafts and Donor Sites

Split-Thickness Skin Graft This graft is the kind most frequently used Many factors influence the success or failure of a graft, but, next to the proper preparation of the wound for grafting, the dressing of the wound has more to do with the survival of the graft than does any other procedure

Several things should be considered in selecting a dressing that is suitable First, the condition of the wound at the time it is grafted should be appraised Fresh surgical defects can be dressed differently than chronic wounds with low-grade infections Second, the location or site of grafting should be considered Grafts on eyelids cannot be dressed with a pressure dressing one could use on an arm Grafts placed inside the mouth cannot be managed the same as a graft in the inguinal region

Dressings Many types of dressings are in use, but one of the following will be suitable for most split-thickness skin grafts

1 PRESSURE-TYPE DRESSING This is the type most frequently used to cover the newly grafted surface The uniform pressure that it exerts helps to prevent collections of blood and serum under the graft, and it minimizes edema in the area The material selected (nylon fabric, rayon, silk, or a fine-mesh gauze impregnated with Xeroform) for the first layer of the dressing is one that has a mesh too fine to admit granulations The second layer is made of ordinary gauze folds which are laid on smoothly The third layer should be 2 to 3 inches in thickness and can be composed of any of

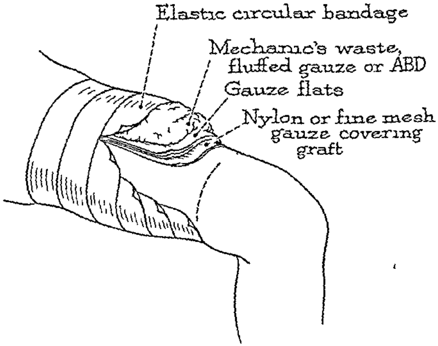

Fig 1 Pressure type dressing

the following materials mechanic's waste, fluff gauze, or ABD pads The outermost layer provides mild pressure and holds the other dressings in place This is either an elastic circular bandage (Ace), or may be an elastic adhesive (Elastoplast) if the graft is in an area like the chest or abdominal wall (Fig 1)

2 STENT- OR BOLSTER-TYPE DRESSING This is needed in special regions where ordinary dressings cannot be relied upon to produce satisfactory pressure and immobilization Examples of such areas would include the inside of the mouth, the lips, the eyelids and the neck

The bolster-type dressing requires that the ends of the sutures which have been used to sew the graft in place be left long These ends are then tied over a form or a pad composed of waste, cotton, gauze, or other ma-

terial In many situations it is possible to apply an outer dressing over the pad (Fig 2)

The stent-type dressing is commonly used for grafts inside the mouth The graft is applied directly to the form (usually dental modeling compound) so that the raw side of the graft faces outward and the epidermal

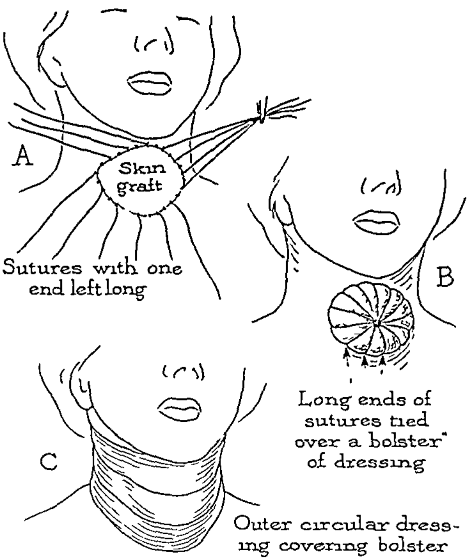

Fig 2 Bolster-type dressing

side is in contact with the form The graft and form are then inserted into the defect and are held in place by additional sutures (Fig 3)

3 WET DRESSINGS These are indicated for quite dirty wounds which could not be cleaned up before operation, or when there is sufficient reason to fear that infection will injure the graft The graft is covered with a layer of fine-mesh gauze Gauze flats and fluff gauze are next applied The dress-

ing is soaked with a solution of boric acid or physiological saline solution Next, an impermeable layer of gutta-percha, oil silk, rubber dam, plastic, or similar material is applied over the dressing, this should be large enough to reach the skin on all sides beyond the deeper layers of the dressing A thick layer of cotton, ABD pads or mechanic's waste is applied over the impermeable layer to give support This is retained by a carefully applied

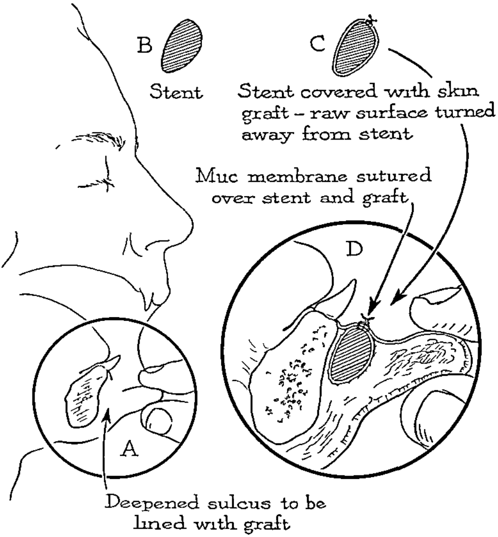

Fig 3 Stent type dressing

circular bandage This dressing will remain moist for twenty-four hours and does not require the use of rubber tubes or catheters as a means of applying solution to keep it wet

4 EXPOSED GRAFTS In certain situations dressings are omitted, because the region grafted is one where even the most carefully applied dressing would soon be displaced An area which is difficult to dress properly is the inguinal region In places like this, one may have a high degree of

success with grafts if they are cut in pieces the size of a postage stamp, are backed with sterile brown wrapping paper and laid raw-side down on the recipient site No dressing is applied A wire frame or heat cradle (with no lights in it) can be used to keep the bed linens from coming into contact with the patient The patient is instructed to lie flat and as quietly as possible When he does move, he is to watch the paper-covered grafts, observing that his motions do not disturb them Within four or five days the paper backing begins to separate from the grafts If crusts from dried exudate form in the spaces between the grafts, they can be soaked off by moistened gauze flats applied directly to the area for several hours each day The patient's activity must be restricted for ten days

Management of a Split-Thickness Skin Graft Donor Site Protection of the sterility of the donor area is of extreme importance Severe infections of donor sites are not common, but, when they occur, they present difficult problems and require many weeks for healing Infection may be the result of carelessness in the operating room, or may result from slipping of a poorly applied dressing with exposure and irritation of the donor site

Generally the donor site is covered with the pressure-type dressing To prevent slipping, adhesive tape can be used to anchor the dressing which ordinarily is left in place until the donor site is healed and needs no further protection The time will vary between ten and fourteen days, depending upon the thickness of the graft taken Complaints of increasing pain or the appearance of an exudate along the edges of the dressing should arouse suspicion that an infection is present When it is suspected that this is the case, the exact status of the donor site can be determined by removing the dressing When infection is present, wet dressings are started without delay

Subsequent Dressing of Split-Thickness Skin Grafts The time for the first dressing change is frequently decided in the operating room when the graft is being applied This decision is influenced by the nature of the site being grafted Contaminated sites and sites where hemostasis was doubtful because of continued capillary oozing should be inspected earlier than those fresh surgical defects in which infection or bleeding under the graft is not a likely possibility

Grafts applied to clean surgical defects in which hemostasis was satisfactory may go as long as six or eight days without a dressing change If, however, continued capillary oozing was a problem during the operation, the dressing should be removed and the graft inspected within twenty-four hours If a hematoma is present beneath the graft, it can be gently evacuated and the dressing reapplied with firm pressure to bring the graft into contact with the entire recipient site

Grafts that have been applied to granulating defects are usually dressed on the fourth or fifth day The dressing may, however, be removed as early as the second day if there was much concern over the cleanliness of the area at the time of grafting

The reward for gentleness in removing the dressing is the survival of a high percentage of the graft If the dressing is stuck, it should be soaked loose, and the inner layer of the dressing separated from the graft with the greatest of care Except in those wounds whose dressings are done early, the sutures are removed at the time of the first dressing Dead, overlapping edges of the graft are trimmed away If scattered areas of infection are present, more cleansing may be needed The blebs should be opened, the pus evacuated and dead portions of the graft cut away If exudate has made the surface of the graft messy, the area should be gently washed with soap and water Wet dressings are started and continued daily until the area cleans up

A hematoma under a graft must be removed This can be done with relative ease by incising the graft over the hematoma and then expressing the effused blood That portion of the graft which was over the hematoma will have a fair chance of survival if a pressure-type dressing is applied

Determining when the graft has "taken" is seldom a problem for experienced surgeons A graft that has taken will show no evidence of infection, will be firmly adherent to the underlying tissues and will have a pink color When healing has been uninterrupted, one may discontinue all dressings by the tenth or twelfth day, except when the area is subjected to motion or trauma, in which case protection should be provided as long as three weeks

FULL-THICKNESS SKIN GRAFTS These are free grafts of full-thickness skin down to the level of the subcutaneous tissue They are used less frequently than split-thickness grafts, and are reserved for situations demanding a better cosmetic or functional surface and presenting a recipient site that can meet their exacting requirements

Dressings These may be of a type similar to the pressure- or bolster-type dressings described for use with the split-thickness grafts Extra care must be taken to insure adequate immobilization Unless a complication develops, the dressing should remain in place for at least eight days When it is removed, all sutures are taken out If the graft is clean, the dressing is reapplied If blebs are present on the surface of the graft, they should be opened and dead epidermis cut away Sloughs should be removed, especially if there is any pus under them The presence of infection is an indication to start using wet dressings

Donor Areas The smaller donor areas are often closed primarily

by undermining the skin edges and the bringing them together to eliminate the defect The donor sites from which larger full-thickness grafts have been taken cannot be handled by primary closure, and must be covered with a free split-thickness skin graft to avoid leaving a large open wound When a split-thickness skin graft is used to cover the donor site, its management becomes the same as that employed in caring for any split graft to a clean wound

Tube Pedicles and Flaps

Flaps and tube pedicles serves as sources of full-thickness skin and subcutaneous tissue They are characterized by the fact that for a period of time they must be attached to both donor and recipient sites They cannot survive if detached from the donor site before they have developed a sufficient blood supply from the recipient site

Anything which interferes with the circulation in the tube or through the base of the pedicle before the new blood supply is established will produce necrosis of the flap or tube Factors which interfere with the blood supply are displacement, tension, torsion, constriction and infection More flaps are lost from inadequate venous drainage than from insufficient arterial blood supply Inadequate venous drainage manifests itself first by cyanosis, then blistering, and finally gangrene

Flaps and tubes require early and frequent inspection to guard against displacement, torsion and constriction The circulation at the very end of the tube or flap must be checked within two hours after the operation and every two to three hours for the remainder of that day It should be inspected twice daily after that The end can be exposed for inspection by removing the dressing over it At all other times the dressing should be in place The color of the skin should be noted The color changes at the end of the flap are guides to the circulatory status—duskiness indicates venous congestion, and blanching is indicative of insufficient arterial supply Arterial circulation is judged by pressing on the flap and noting how quickly the color returns when the pressure is released A hematoma developing under the flap should be evacuated before the pressure it exerts on the under surface of the flap causes compression and thereby interferes with the circulation within the flap

The pedicle must remain free of pressure, constriction, kinks and tension It will tolerate only minimal torsion (A tube tolerates torsion and angulation slightly better than does a pedicle flap) Whenever there is the possibility that motion might result in tension, torsion, angulation, or constriction, it becomes necessary to immobilize the adjacent joints and parts Often a plaster cast is the only means of providing sufficient immobiliza-

tion, although in many situations adhesive tape and bandages will provide adequate support and restraint

An average of two to three weeks is needed before the end of a tube or flap picks up a blood supply from the recipient site which is capable of sustaining the transplanted tissue As a means of hastening and encouraging this blood supply, the circulation through the base of the pedicle can be occluded periodically for short intervals after the first ten days The time of occlusion is gradually increased as the time for the appearance of color changes in the end of the flat is increased The pedicle can be occluded by

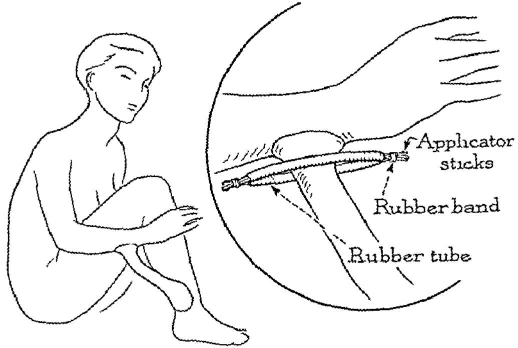

Fig 4 Tubed pedicle and method of occlusion of its circulation

compressing it with a rubber-covered intestinal clamp or a simple device illustrated in Figure 4 Compression is applied along the base of the pedicle with just enough pressure to cut off the blood supply without bruising the tissues

Operations on the Face

General Points in Postoperative Care The patient should have the constant attention of a well-trained alert person Some patients continue to bleed and others are subject to blocked airways After all mouth operations it is wise to place the patient in the prone position so that fluids can run out of his mouth The head should be lowered or carefully held over the edge of the bed if the patient is asleep and having trouble with choking Aspiration should be used to remove fluid and secretions from the

back of the throat and mouth The suction machine and catheter must be available and ready for use at all times

One must be certain that the airway is open and that there is a free exchange of air before leaving the patient alone for even a few minutes If the exchange is not free, the rubber airway (mouth or nasal) should be adjusted to different levels and the throat aspirated If the blocking is not relieved, the tongue should be pulled forward (with a towel clip, if necessary), and the back of the throat inspected and palpated for loose packs and clots, which must be removed at once Tight dressings must be loosened These measures should be instituted and executed quickly

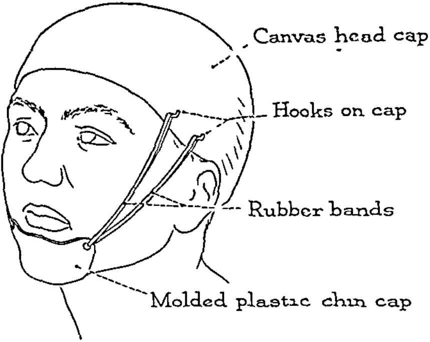

Fig 5 Head cap and chin cap for immobilization of jaws

Facial Bone Fractures *Mandibular Fractures* The essentials of treatment, as in all other fractures, are accurate reduction and immobilization Seldom are complicated appliances needed Most fractures that occur in adults and older children with good teeth can be immobilized by the use of wires which hold the teeth of the lower jaw in occlusion with the teeth of the upper jaw (Gilmer interdental wiring) A tooth lying in the line of fracture should usually be left in place during the period of immobilization This is especially true of molar teeth which tend to prevent the upward displacement of the posterior fragment General anesthesia is not desirable when the jaws are going to be wired since there is a danger of postanesthetic nausea and vomiting causing asphyxia If a general anesthetic is used, the

upper and lower wire loops are applied, but the connecting wires between the upper and lower teeth are not put on until the patient is fully awake and the danger of vomiting is passed

When the upper and lower teeth are wired together the patient should be instructed regarding the quick removal of the wires should he experience nausea or the threat of vomiting Ordinarily, union across the fracture site will be sufficiently firm to permit the removal of the wires in five to six weeks During this period, the patient lives on a liquid diet He maintains his oral hygiene by the use of mouthwashes following meals and by removing accumulations of material from the outer surfaces of the teeth and the wires with a small toothbrush

Fractures occurring in edentulous jaws and having only minimal displacement of the fragments can be treated by the most conservative measures Sufficient immobilization is obtained by having the patient wear a head cap and chin cup (Fig 5) These are applied with only enough pressure to remind the patient that excessive talking and chewing are to be avoided

Fractures occurring in edentulous jaws and presenting marked displacement of the fragments (especially lateral displacement) require open reduction and direct wiring of the bone fragments Occasionally a Kirschner wire is passed through the mandible and across the fracture site If a Kirschner wire is used, it is cut off about 1 cm outside the skin and the exposed end is covered with a small dressing until the wire is to be removed, usually four to six weeks later

Zygomatic-Maxillary Fractures These fractures are frequently overlooked because of the swelling that accompanies them As the swelling subsides, both physician and patient become aware of an abnormal flatness on the injured side of the face Treatment consists of replacing the fragments and retaining them in position with as little manipulation as possible Generally, an open reduction is required, and, if the fragments, after being reduced, will lock in place, no other means of stabilization is needed When, however, there is extensive comminution, it may be necessary to wire some of the fragments and support the anterior antral wall with a petrolatum gauze pack This pack is placed in the antrum by making an incision in the upper buccal fornix and inserting the pack into the antrum through the incision and through the fracture line in the anterior antral wall The end of the pack is left protruding from the incision in the fornix The pack is allowed to remain for ten days, unless elevation of temperature or local signs indicate that the pack is a source of trouble If this occurs, the pack must be removed Pressure on the cheek (as from ice bags, pressure dressings, and the like) must be avoided

Nasal Bone Fractures To simplify the presentation, these fractures will be considered in two categories (1) those that are laterally displaced from a side blow, and (2) those that are depressed ("squashed in") from a frontal blow

After the laterally displaced fractures are reduced, they have very little tendency to become displaced again, and their management is not difficult The depressed fracture, however, has a much greater tendency toward displacement after reduction After elevation, petrolatum gauze packs are inserted in the nostrils to control hemorrhage and to prevent overcorrection with narrowing of the nostrils and airways The packs are removed in forty-eight hours An external aluminum nasal splint is used to protect the nose from further injury

When the nasal bones have been comminuted and the septal support is badly shattered, there is a strong tendency for the septal fragments to sink inward carrying the nasal bone fragments with them These fractures may require the use of through-and-through wires between the nose and and the face The sutures are tied over pieces of lead or tin-foil plates on either side The regular light aluminum splint is applied over the nose and the plates This splint should be removed every other day The skin of the nose is to be cleaned and inspected for signs of pressure resulting from the splint or the plates The total period of immobilization averages between ten and fourteen days

OPERATIONS ON THE NOSE *Preparation for Surgery* When an operation is to be done from within the nose, the hairs inside the nostrils should be clipped and any dried crusts removed the night before the operation Just before the start of the operation, the inside of the nose is again cleaned

Care Following an Osteoplastic Rhinoplasty The patient should lie quietly for the first few hours The head should be slightly elevated Gauze pads wrung out in ice water (*not ice bags*) may be applied to the eyelids during the first day to minimize swelling

The small petrolatum gauze packs which are inserted into each nostril at the end of the operation are an aid in controlling postoperative bleeding These should be removed on the second day The packs are then left out unless bleedings starts, in which case clean packs soaked in 1 5000 epinephrine solution are reinserted for another twenty-four hours At the time the packs are taken out, the patient must be warned against blowing his nose

Pain is seldom a cause of complaint If present, codeine and aspirin are often sufficient for relief A mild sedative given at bedtime helps to relieve the discomfort from enforced mouth-breathing

The triangular gauze dressing taped over the end of the nose helps to retain the petrolatum gauze packs and absorbs blood during the first day

or two Unless this pad becomes unusually soiled with blood, it is not touched until the second day, when the packs are to be removed

The nose may be supported with a splint The material used should be light and easily molded It is held in place by strips of adhesive tape which extend onto the cheeks The splint can be removed by the fourth day and is seldom needed more than ten days

The sutures within the nose are removed on the tenth day

Rhinoplasties with Cartilage Implants The cartilage may be taken from the patient's thoracic cage, or it may be preserved homogenous cartilage

If the patient's costal cartilage is to be used, the area between the clavicles and the umbilicus should be shaved and washed with soap and water the night before the operation It is washed again and rinsed with alcohol before the start of the operation

If sterile homogenous cartilage is to be used, it should be brought to the operating room before the start of the operation The cartilage is stored in a solution of 1 5000 colorless aqueous Merthiolate and kept in the refrigerator at 40° F It may be preserved for many months, if the solution is cultured and changed each week At the time the cartilage is obtained, it is placed in a 1 1000 solution of colorless Merthiolate for two weeks If, at the end of that time, a culture of the solution is negative, the 1 5000 solution is substituted

OPERATIONS ON THE LIPS AND MOUTH *Cleft Lip Repairs* Repairs are generally undertaken early, usually when the child is between two and six weeks of age An infant will tolerate surgery better if he weighs at least 7 pounds Infants who are being brought into the hospital should be admitted forty-eight hours before the time of surgery to provide ample opportunity for observation Conditions which contraindicate surgery are jaundice, respiratory infections and pustular skin eruptions The hemoglobin level should be 10 gm or above

PREOPERATIVE PREPARATION Because excessive bleeding is a hazard in these operations, the child should have an adequate vitamin C intake for at least two weeks prior to surgery Bleeding and clotting times should be checked before the operation Abnormal results require that further investigation be made

The child must not be dehydrated when he is brought to the operating room Infants may be given their formula of milk until four hours before operation and 6 per cent sugar water up to two hours before operation With older children, the breakfast is omitted, but they can have clear liquids up to two hours before surgery

POSTOPERATIVE CARE The patient is kept under constant observation

until it is certain that there is no obstruction to the airway and that bleeding has stopped If bleeding occurs, the child should be turned face down until the bleeding is controlled If, after fifteen to thirty minutes, no further bleeding is encountered, he may be placed in a more comfortable position *Repeated swallowing* may be a sign of hemorrhage Continuing hemorrhage requires packing under the lip

The suture line should be kept clean A mild alkaline antiseptic solution on a piece of cotton can be used to remove any crusts that form from nasal secretions or following feedings

Water may be given as soon after the operation as the child can take it The food may be of the same type as he was given before his operation, but he should not be put to the breast or given a bottle Instead, feeding should be done with a dropper, a syringe, a cup, or a spoon At the end of seven days, the previously bottle-fed baby may return to the bottle provided the holes in the nipple are enlarged The breast-fed baby may return to the breast after the fourth day of syringe feeding

The child must be prevented from getting his hands near his mouth This can be done by the use of arm cuffs or well-padded splints that keep the forearms extended

The pack is removed from the nostril at the end of forty-eight hours Sutures in the skin are removed between the fourth and sixth days, those inside the lip, if nonabsorbable, can be removed after the tenth day

Cleft Palate Repairs There is still disagreement concerning the ideal age at which surgical repair should be undertaken There is no reason for urgency, and most repairs are delayed until the child is at least eighteen months old

PREOPERATIVE PREPARATION These children may suffer from various degrees of anemia, because of feeding difficulties The level of hemoglobin should be checked, and, if found low, a transfusion should be given before the operation Ten grams is considered the minimal hemoglobin level

Otitis media is a complication commonly associated with an open palate It is not a contraindication to operation, unless it is in a stage of acute exacerbation This can readily be determined by the appearance of the tympanic membranes, the temperature and the white blood cell count

Feedings and fluids can be continued up to the time of operation, as was outlined for older children being prepared for cleft lip operations

POSTOPERATIVE CARE There must be constant attendance of the patient until all doubt concerning respiratory obstruction or continued bleeding is removed The child should be turned so that his face is down until it is certain that bleeding has stopped Repeated swallowing is a sign of continued bleeding, while restlessness may indicate excessive blood loss or

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The sutures within the nose are removed on the tenth day

Rhinoplasties with Cartilage Implants The cartilage may be taken from the patient's thoracic cage, or it may be preserved homogenous cartilage

If the patient's costal cartilage is to be used, the area between the clavicles and the umbilicus should be shaved and washed with soap and water the night before the operation It is washed again and rinsed with alcohol before the start of the operation

If sterile homogenous cartilage is to be used, it should be brought to the operating room before the start of the operation The cartilage is stored in a solution of 1 5000 colorless aqueous Merthiolate and kept in the refrigerator at 40° F It may be preserved for many months, if the solution is cultured and changed each week At the time the cartilage is obtained, it is placed in a 1 1000 solution of colorless Merthiolate for two weeks If, at the end of that time, a culture of the solution is negative, the 1 5000 solution is substituted

OPERATIONS ON THE LIPS AND MOUTH *Cleft Lip Repairs* Repairs are generally undertaken early, usually when the child is between two and six weeks of age An infant will tolerate surgery better if he weighs at least 7 pounds Infants who are being brought into the hospital should be admitted forty-eight hours before the time of surgery to provide ample opportunity for observation Conditions which contraindicate surgery are jaundice, respiratory infections and pustular skin eruptions The hemoglobin level should be 10 gm or above

PREOPERATIVE PREPARATION Because excessive bleeding is a hazard in these operations, the child should have an adequate vitamin C intake for at least two weeks prior to surgery Bleeding and clotting times should be checked before the operation Abnormal results require that further investigation be made

The child must not be dehydrated when he is brought to the operating room Infants may be given their formula of milk until four hours before operation and 6 per cent sugar water up to two hours before operation With older children, the breakfast is omitted, but they can have clear liquids up to two hours before surgery

POSTOPERATIVE CARE The patient is kept under constant observation

chin The collar is then wrapped firmly, but not tightly, around the neck and is finally tied with tape

Operations on the Hand

SURGERY FOR DUPUYTREN'S CONTRACTURE If both hands are involved by the disease, only one hand is selected for repair at a time This is done to avoid making the patient totally dependent during the postoperative period

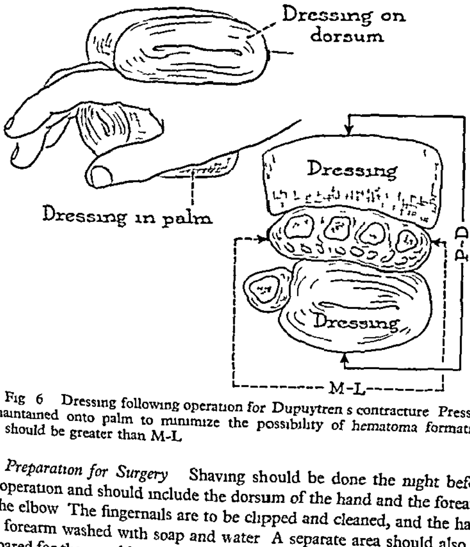

Fig 6 Dressing following operation for Dupuytren s contracture Pressure is maintained onto palm to minimize the possibility of hematoma formation P-D should be greater than M-L

Preparation for Surgery Shaving should be done the night before the operation and should include the dorsum of the hand and the forearm to the elbow The fingernails are to be clipped and cleaned, and the hand and forearm washed with soap and water A separate area should also be prepared for the possible use of a full-thickness skin graft The site selected must be as free of hair as possible The inner aspect of the upper arm of the opposite side is suitable

Postoperative Care The dressing that is applied to the hand must be designed to maintain pressure on the palm to minimize the possibility of hematoma formation (Fig 6) Hematomas are complications which are too

respiratory obstruction If the child is having difficulty in breathing, the pack, which was placed under the palate flaps, may have become dislodged and be hanging down in the pharynx

Fluids by mouth may be started just as soon as the child wants them, usually in two to three hours The feedings should be given from a cup or spoon By the evening of the operation, the feedings of thin-cooked cereals and pureed foods may be started After each feeding the mouth can be cleansed by giving a little warm water Hard foods are to be avoided for one month During this period the patient should be prevented from putting his fingers in his mouth He should not be allowed to have small toys that he might put in his mouth

Fever in the postoperative period may be due to dehydration or a flare-up of the otitis media The otitis should be treated by giving antibiotics and performing a myringotomy, if indicated

Sutures are seldom removed in cleft palate cases Nearly all will have fallen out in thirty days, and any that remain after another month can be removed

Packs used under palate flaps generally remain for forty-eight hours If they are the cause of discomfort, they are removed sooner

Do nothing to cause a child with a cleft palate repair to struggle or cry

Operations on the Neck

PREPARATION FOR SURGERY When the operation is apt to be extensive, as in patients undergoing neck dissections, the area shaved should extend from the top of the ear around to the middle of the back of the head on the side to be operated upon, and should include the entire neck and anterior chest as far down as the nipples

POSTOPERATIVE CARE Constant attendance is needed until the patient is fully awake One must watch for signs of bleeding or difficulty in breathing and swallowing Evidence of bleeding should be reported to the surgeon immediately If there is any evidence that the dressings have been applied too tightly, they should be loosened The initial dressings are usually changed by the second day Drains are rarely left in for more than four days, and are frequently removed sooner, depending upon the amount of discharge noted at the time of the dressing change

If skin grafts have been applied to the neck, a suitable method of immobilization must be provided A Schantz collar is very useful and is simple to make A piece of stockinet 72 inches long and 8 inches wide is filled with a dozen layers of sheet wadding of proper width The ends of the stockinet are then stitched and a piece of tape is sewn to one end The collar is applied over the wound dressing and wrapping is started under the

Chapter 15

THE TREATMENT OF BURNS

ROBERT I STOKES, M D

THE BURNED PATIENT, in his fight for survival, reacts to the injury with variable and complex compensatory adjustments If the adjustments are successfully made the process ends with recovery If, however, the response is inadequate, additional pathological processes develop to bring him closer to death

Not all burns are severe enough to threaten life, but all deep burns and those that involve more than 10 to 15 per cent of the body surface are major traumatic insults capable of producing death unless the individual receives adequate support during the period when profound demands are being made upon his physiological reserves

An outline of treatment can be of value only if it is used as a guide that is intelligently modified and altered to meet the individual problems of each patient as they become apparent Some problems can be anticipated and, by proper therapy, avoided, but it is wise to remember that the "rules" in medicine are notorious for their exceptions

The treatment of burns is a complex subject In an attempt to avoid confusion in this presentation, it will be made in two sections one dealing with general supportive therapy, and the other with the local care of the burned surface

GENERAL SUPPORTIVE THERAPY

Relief of Symptoms

PAIN The amount of pain experienced varies greatly When pain is severe, morphine or Demerol is the drug of choice It should be given via the intravenous route Children and elderly adults often respond to a milder

frequent and are favored by an improperly applied dressing The metacarpophalangeal joints are immobilized by the dressing, but the proximal and distal interphalangeal joints are allowed freedom of motion If a drain had been used, it is removed twenty-four hours later and the dressing reapplied Dressings are needed for two weeks during which time they maintain the metacarpophalangeal joints and distal palmar crease immobilized When a free graft is used, the period of immobilization is extended for one more week

The skin sutures remain for a full two weeks

Surgical Repair of Tendon Injuries *Preparation for Surgery* The hand and forearm are shaved and cleansed in the same manner as was outlined for patients with Dupuytren's contractures When a tendon graft is to be taken from the foot and ankle, the lower extremity is also prepared the night before the operation Shaving extends to the level of the knee

Postoperative Care After a tendon is repaired, splinting is indicated. Flexor tendons require immobilization of the wrist in a position just short of full flexion This can best be achieved by using a plaster-of-paris splint which extends from the upper third of the forearm over the dorsum of the wrist and hand to end at the level of the metacarpophalangeal joints A circular bandage is used to hold the plaster splint in place The fingers are left free to move

Extensor tendons require immobilization of the wrist in nearly complete extension This is achieved by the use of a plaster splint which is applied to the flexor surfaces of the forearm, hand and fingers When the tendons were severed in the fingers, the splint should extend as far as the *distal creases of the fingers If the site of severance was in the dorsum* of the hand or the forearm, the splint need extend only as far as the proximal interphalangeal joints

Immobilization should continue for three weeks if the tendons have been repaired by use of a "pull-out" wire If silk was used to repair the tendons, motion is permitted about one week earlier

Skin sutures can be removed after the fourteenth day, if there is no evidence of delayed wound healing

When immobilization is discontinued, the patient is allowed to use his hand, but is warned against forceful active motion before the end of six weeks

into the area of injury and to provide those needed to meet daily obligatory requirements

There is a general tendency to overestimate the extent of a burn and to underestimate its depth Most experienced observers admit difficulty in estimating the depth of burns, the depth usually being greater than first estimated

After all remaining clothing is removed, an estimate of the percentage of the body surface involved by the burn can be made by using the approximate "Rule of Nine"

PERCENTAGE		PERCENTAGE
9	Head	9
1	Neck	1
9	Each Upper Extremity	9
18	Anterior Trunk	18
18	Posterior Trunk	18
18	Each Lower Extremity Including buttocks	18

Note The above figures are not valid for infants and children because head and trunk surfaces are relatively greater

Several formulas are available for estimating the quantity of fluids required, but it should be emphasized again that the arbitrary application of any formula to individual problems frequently leads to over- or under-correction of the disturbance and a false sense of security

The "*surface area—weight formula*" is useful in calculating fluid needs of adults and older children who have burns that involve up to 50 per cent of their body surfaces This formula SERVES AS A BASIS for calculating the amount of fluid needed to compensate for the loss of extracellular fluid into the interstitial spaces

BLOOD	Body weight (kilograms) × percentage of body surface involved equals the amount of blood (cc) to be given in first twenty-four hours (One-half of this amount to be given in the first eight hours, the remaining half to be given during the next sixteen hours)
ELECTROLYTE CONTAINING SOLUTIONS	Body weight (kilograms) × percentage of body surface involved equals the amount of electrolyte containing fluid to be given in the first twenty four hours (One-half of this amount to be given during the first eight hours, the remaining half to be given during the next sixteen hours)

Fluids to satisfy "obligatory water requirements' are those needed to provide for the normal daily losses through the skin, lungs, kidneys and

drug which can be given orally When morphine is used for a child, the dose is approximately 1 mg for each 10 pounds of body weight

HYSTERIA This is seen occasionally It responds well to barbiturates and the administration of oxygen

Prevention and Treatment of Complications

EDEMA OF THE GLOTTIS AND PULMONARY EDEMA These require prompt and vigorous treatment Hoarseness is a symptom of laryngeal involvement Crowing noises, gasping and cyanosis may or may not be present An emergency tracheotomy must be performed if edema of the glottis threatens respiration Oxygen must be given if pulmonary edema is developing Postural drainage and tracheobronchial aspiration may be of additional value The respiratory emergency is often called the "only true emergency in burns"

SECONDARY SHOCK Shock with its profound disturbances in fluid and electrolyte balance and its impairment of renal function must be anticipated and prevented If developing, it must be treated

Shock is initiated by the destruction of blood cells and by the loss of extracellular fluid into the area of injury This decrease in blood volume results in a decrease in blood flow, lowering of blood pressure, tissue anoxia and an increase in capillary permeability with a further loss of blood volume

The time of onset of shock is usually somewhere between two and twelve hours after the burn was sustained The peak of shock corresponds with the period of maximum tissue edema which usually occurs in thirty-six to forty-eight hours

Children will exhibit symptoms of shock earlier than adults, and intense thirst is one of the earliest symptoms Other symptoms to be watched for are complaints of being cold, apprehensiveness and restlessness As shock becomes more profound, the apprehension may be replaced by stupor Lowered body temperature, decreased blood pressure, skin pallor and a pulse that is weak and thready are well recognized signs of shock

Therapy is instituted to compensate for the distributional shift of extracellular fluid and to correct the disturbances in osmolar concentration and composition that develop as the result of this shift To provide proper treatment, one must know how to calculate the approximate quantities of fluid that are needed and what fluids are best suited to meet these needs, and then be able to evaluate the adequacy of therapy

Estimation of Fluid Requirements The quantity of fluid needed is influenced by several factors—extent of the burn, depth of the burn, the size and the age of the individual The fluids will be used to replace those lost

oral route Moyer has warned against the danger of "water intoxication," a condition manifested by headache, vomiting and convulsions It is believed that this is the result of a lowering of the osmolar concentration of the plasma solutes by the ingestion of large quantities of water when the rate of urinary excretion is low As a means of preventing this condition, it has been recommended that water by mouth be restricted for two to three days after the injury and that a sodium salt solution be used for drinking This solution is made by dissolving 3 to 4 gm of sodium chloride and 1 5 to 2 gm of sodium bicarbonate in a liter of iced drinking water Adults and older children tolerate this preparation better than do infants and younger children, who are very apt to vomit when given preparations which are not extremely palatable

Control of Fluid Therapy It must be remembered that the suggested formulas are only guides and the adequacy of therapy will have to be judged by close clinical observations and repeated laboratory studies

Clinical control of fluid therapy depends upon an accurate account of the patient's urinary output and a careful appraisal of the patient's response

Urinary output recording is one of the best methods of determining whether the fluid needs of the patient are being satisfied To insure accurate recording, an indwelling catheter should be used An average adult who maintains a urinary output of 50 to 100 cc per hour is receiving enough fluid A falling or low urinary output of 30 to 5 cc for three hours or more indicates that therapy is inadequate and an increase in the amounts is indicated An output of more than 100 cc per hour for six hours calls for a reduction in fluid therapy if pulmonary edema and congestive failure are to be avoided

If large amounts of fluid are being administered, and the hourly urinary output remains low for many hours, this should suggest one of two possibilities an insufficient quantity of fluid is being given, or a renal lesion renders a greater urinary output impossible To continue therapy, if the kidneys are incapable of responding, is to lead the patient into congestive failure The differentiation of these two fundamentally different causes can be determined by administering 1000 to 1500 cc of fluid rapidly by vein within a period of one hour If a clear-cut increase in hourly urine output occurs, one may safely conclude that the kidneys are able to handle the water, but that the wound demands are not being met by the previous course of treatment If there is no kidney response, it becomes necessary to continue the intravenous therapy with extreme caution

Appearance and response of the patient are indispensable in judging the effectiveness of treatment One should repeatedly note the mental status, the strength of the hand grip, the temperature of the uninjured extremities,

other avenues The amounts will vary depending upon the age of the patient, presence or absence of fever, vomiting, humidity and temperature of the room, and diarrhea or other abnormal losses Approximate values are

			ML
ADULTS	Urine		1500
	Feces		100
	Lungs		400
	Skin		600
		Total	2600 ml /day

CHILDREN The total amount required by a child is less, but, based upon body weight, the amount is relatively greater

Infants (2–10 kg)	300–840 ml /day
Children (10–40 kg)	840–1500 ml /day

Composition of Fluids Blood and sodium-containing electrolyte solutions have been found to be the most effective in combating shock and restoring electrolyte balance

Blood restores circulating blood volume quickly and severe anemia is less likely to develop when blood is given during the early stages of treatment than is otherwise the case Often there is a delay in the administration of blood because time is required for typing and crossmatching The peripheral veins should not be allowed to collapse during this interval, and treatment should be started using plasma or dextran Normal saline solution may be used temporarily for shock therapy to prevent the collapse of veins If plasma or dextran is used, the amount given should be subtracted from the calculated amount of blood to be administered

After the blood is given, solutions containing sodium are administered to help establish normal electrolyte balance Ringer's solution, lactated Ringer's solution or physiological salt solution may be used

Acidosis may be present and should be treated It is often the result of a combination of factors—loss of bicarbonate (with sodium) into the interstitial spaces, starvation ketosis, infection and retention of acid metabolites due to impaired renal function An attempt should be made to keep the carbon dioxide combining power above 40 volumes per cent If acidosis exists, a one-sixth molar solution of sodium lactate may be given if liver function is adequate Sodium bicarbonate solution should be reserved for those patients having severe acidosis with known liver damage

The additional fluids needed to meet the daily obligatory requirements can be given as 5 per cent solution of glucose in distilled water If the patient is able to drink, part of his requirements can be satisfied by using the

the first seventy-two hours in severe burns The number of red cells destroyed during this period varies with the extent of tissue destruction Generally, the relative number of cells destroyed is small, but infection adds to the difficulty, and there develops a chronic anemia which must be combated until healing is complete Patients who have been given blood early are less apt to develop anemia as severely as those who were treated with plasma

Healing will be more rapid and grafting more successful if the hemoglobin value is maintained at 85 per cent or higher Frequent transfusions are needed to maintain this level and a liter or more of blood each week may be required The intake of large quantities of iron, liver, proteins and calories is of definite value, but alone is rarely sufficient to keep the hemoglobin level at the desired 85 per cent

INFECTION There is evidence that at least part of the "toxemia" of burns is the result of infection Certain precautions must be observed to keep infection at a minimum These include proper care of the burned area with avoidance of additional contamination, early grafting and the use of antibiotics Care of the burned surface and early grafting are discussed under another heading

Tetanus is a terrifying disease which, though rare, may occur in burn patients if prophylactic treatment is omitted or inadequate For those who have been actively immunized with tetanus toxoid, a booster dose of 1 cc is indicated Fifteen hundred to 3000 units of tetanus antitoxin should be given to all others after they have a skin test

Antibiotics are of value in controlling infections in burns Penicillin may be given, using 300,000 units of procaine penicillin fortified with 100,000 units of crystalline penicillin G in oil every twenty-four hours The wide-spectrum antibiotics are of value in prevention and control of infection Organisms identified from cultures of the wound surface should be tested for sensitivity The most suitable antibiotic can then be selected and used

MALNUTRITION This is a problem frequently seen in the severely burned patient It is probably due to a combination of toxicity, inanition, and infection In those with severe burns, there is an increase in the anabolism of protein and a tremendous rise in the urinary nitrogen excretion and an increase in the nitrogenous elements in the stool

Every effort must be made to maintain adequate nutrition The food provided must be high in calories and contain a complete metabolic mixture of protein, carbohydrates, fats, vitamins and minerals Adults with burns that involve 10 to 19 per cent of the body surface require 200 gm of protein and 3500 calories per day Those with burns of over 20 per cent require as

the character and rate of the pulse, the blood pressure and the moistness of the membranes Repeated auscultation of the lung fields should be done to detect the presence of basal rales, warning of the development of pulmonary edema

Laboratory studies are of value in the control of fluid therapy, but the results should be correlated with the clinical findings When they are at variance, the studies should be repeated and checked by other methods

Repeated *hematocrit* determinations have been stressed by many authors as an invaluable method of gauging the patient's needs and response to fluid therapy The method is not without limitations One must not rely completely on hematocrit or hemoglobin determinations, since severe extracellular fluid volume deficits may exist while the concentration of red cells is normal or low This can be appreciated if one is aware that changes in the red cell concentration reflect only the *relative rates of loss* of red cells and extracellular fluid Burns produced by short exposure to scalding water result in the destruction of red cells, but extracellular fluid is sequestered into the still elastic, scalded area more rapidly than the cells are destroyed The result is a rise in the hematocrit value The hematocrit reading may fall if exposure is for a longer period, because the cells are destroyed at a more rapid rate than the fluid is sequestered

The hematocrit value which is low or normal cannot be taken as an indication that no fluid volume deficit exists A high cellular concentration, except in the case of polycythemia vera, is an indication of a fluid volume deficit, but not of how much the deficit exists

The tests that seem to be of greatest value in following the patient's course include routine urinalyses and determinations of the level of plasma proteins, nonprotein nitrogen, carbon-dioxide combining power, and sodium and potassium These should be repeated at frequent intervals, depending upon observed trends in the patient's course

Duration of Fluid Therapy On the second day, the patient will need only one-half as much fluid and blood as he was given on the first day

After forty-eight to sixty hours, the continued parenteral administration of large quantities of fluids is extremely hazardous It is at this time that the edema fluid in the area of the burn is beginning to be mobilized With its return into the intravascular spaces, there is real danger of overloading the circulation The recognition of the onset of diuresis is of the utmost importance A sudden increase in the hourly urine output, with no previous change in therapy, calls for a drastic decrease in the amount of fluid given and a change to the oral route of administration

ANEMIA The anemia begins with the destruction of blood cells at the site of the burn and with the acute hemolytic process observed during

The selection of a method for the local therapy is influenced by a number of factors previous experience and individual preference, extent of the burn and areas of involvement and the available facilities Two of the more commonly used methods are to be presented No claim is made for their superiority nor is there any evaluation of their relative merits

EXPOSURE OR OPEN-AIR METHOD Burns of the face, neck and perineum, and those burns which involve only one side of the trunk or extremities are well suited to this form of treatment The exposure technique is not used beyond the third week for the treatment of full-thickness burns

If the burns are grossly contaminated, they are gently cleaned and irrigated with physiological salt solution The patient is placed in bed upon sterile sheets The burned areas are left exposed to the air Bedclothing which is suspended over a wire frame or cradle will protect the patient from drafts and chilling without coming into contact with the burn The coagulum over the burn dries within two to four days, and at that time, if the feet and legs are not burned, the patient may be permitted to walk and go to the bathroom Even when the exposure method of treatment is being used, the burned hands should be placed in a position of function and protected by pressure dressing for the first three days At the end of this time, the dressings may be removed

Inspection of the coagulum for moisture and cracks should be made every day Areas of softened crust are a source of infection The crusts are removed by use of a scissors and the underlying area is then protected with a single layer of gauze During the second week, the crusts over the areas of second degree burns will be loose enough to fall off or to permit easy removal with forceps If there has been no infection, the coagulum over the areas of third degree burns will still be adherent and contracted, and is ready for excision from the underlying tissue in preparation for grafting

PRESSURE DRESSING TECHNIQUE The use of the word "pressure" as applied to the dressing can be misleading The dressings are designed to provide firm even support Constriction and tourniquet effects *must be avoided* and there should not be much pressure on the chest, abdomen or neck

Cleansing of the burned area is limited to the gentle removal of gross dirt and irrigation with physiological saline solution The burned surface is then covered with a fine-mesh gauze which is laid on smoothly or by a single layer of petrolatum gauze Constricting effects are avoided by laying the strips on longitudinally or cutting them so that each strip is just long enough to encircle the extremity only once Sterile compresses are applied over the fine-mesh gauze, care being used to avoid wrinkles Next, a fluffy covering of absorbent material, such as mechanic's waste or fluffed gauze,

high as 300 to 400 gm of protein and up to 5000 calories per day In addition, large amounts of vitamins, especially ascorbic acid, thiamine, riboflavin and nicotinamide, are needed

The principle of supplying adequate food to patients is simple, but the actual carrying it out is often difficult Forcing the diet may cause nausea and vomiting The sicker patients tolerate fat poorly and the proportion of protein in their diet should be larger

For the first few days, no effort is made to give intensive feedings When the gastrointestinal tract has recovered from shock, oral feedings may be started to meet the increased needs for tissue repair Lack of appetite is an obstacle often encountered in attempting to have the patient eat sufficient food to satisfy his protein and caloric requirements This obstacle can be eliminated by giving continuous intragastric drip feedings through a small intranasal plastic catheter The dietitian may prepare the feedings by suspending 100 gm of skimmed milk powder in 1 quart of milk and adding supplementary vitamins and flavoring

SURFACE TREATMENT OF BURNS

Immediate Local Treatment

The surface treatment of burns has long been a subject of concern to physicians Many acceptable methods are in use today, and, although they may differ in technical details, their aims are similar The objectives of local therapy are to provide comfort and support while not interfering with healing, to prepare the areas of deep burn for grafting, and to skin-graft those areas *that have suffered a full-thickness loss of skin*

It is the patient's natural ability to heal that determines the outcome of a superficial burn, and burns of a minor nature usually heal well following the application of any home remedy or pharmaceutical preparation The danger lies in the mistake of underestimating the depth of a burn and then relying on drugs or ointments to produce healing of whole-thickness burn sites

As soon as steps have been taken to relieve respiratory difficulties and to combat shock, attention should be directed to the initial treatment of the local wound It must be remembered that burn is a wound which must be protected from further contamination All personnel who come into proximity of the patient should wear masks Only sterile instruments, gloves, dressings or sheets should come into contact with burn The use of separate rooms or sections which are isolated from other patients will greatly reduce the danger of secondary infection with hemolytic streptococci

SURGICAL EXCISION This is considered the method of choice by some authorities In this method, on the tenth day, the initial dressing is removed and the extent and depth of the slough are determined Any area larger than 2 or 3 inches in diameter, when there is a hard adherent slough, is to be surgically excised The patient is re-dressed, with fine-mesh gauze being placed next to the slough and a large pressure dressing applied over it On the following day in the operating room with the patient under light general anesthesia, the whole-thickness skin slough is surgically excised down to bleeding tissue All bleeding is controlled by ligature or pressure, and, on completion of the excision, the wound is re-dressed with fine-mesh gauze and a voluminous pressure dressing is applied The patient is returned to his room and given transfusions which are repeated if necessary Following excision, the wound is not disturbed for two or three days The patient is then returned to the operating room and the clean surface is covered with a split-thickness skin graft Surgical excision of the whole-thickness burn slough is not of value in burns of the face or neck, because there is a normally rapid separation of the slough in these areas, due, perhaps, to a better blood supply, and because surgical excision is too prone to remove valuable anatomical structures which cannot be replaced by skin-grafting

Attention should be directed to certain hazardous aspects of this form of treatment In the very extensive burn, blood loss may be excessive if an attempt is made to excise the entire slough at one operation The other danger is the excision of more tissue than is absolutely necessary Often what appears to be all third degree tissue loss is in reality a combination of deep second degree and third degree loss The distinction between the two is extremely difficult even at the end of the second week If this deep second degree area, which contains few but sufficient epithelial structures to heal spontaneously with a somewhat inferior covering, is sacrificed surgically, one may find that the available donor sites are not large enough to provide grafts for the now extensive surgical defect

Skin-Grafting and the Management of Grafted Areas

The techniques of cutting split-thickness grafts are clearly described in the many excellent textbooks of plastic surgery Care of the grafts and donor sites is presented in detail in another chapter of this book

is applied to make a layer 2 to 3 inches in thickness A circular elastic bandage is applied firmly, but not tightly, to hold the under dressings in place When an extremity is bandaged, the parts distal to the burn should be included in the dressing The digits should be separated from each other by a layer of gauze, and hands should rest in a position of function within the dressing The dressing is not changed for ten to fourteen days, unless it becomes soaked by secretions from within or contaminated by urine or feces, or unless signs and symptoms suggesting infection of the burn area should appear

Preparing the Burn for Grafting

It is a common observation that *superficial* second degree burns will be largely healed by the tenth to the fourteenth day Whereas, the third degree burns will have demarcated themselves sufficiently to permit an accurate appraisal of the extent of the third degree in loss There are several methods of removing the adherent burn slough These include surgical excision, pyruvic acid digestion, enzymatic debridement by streptokinase-streptodornase, and by the use of moist saline dressings and debridement each time the dressings are changed Whatever method is chosen, its object is to accomplish skin-grafting as soon as possible, usually during the third week, or between the fourteenth and twenty-first days following the burn Any delay in the closure of these wounds is hazardous because it exposes the patient to further infection, continued loss of plasma and proteins and aggravates the severe secondary anemia that accompanies the burn

Wet Dressing Method By and large, this is the most practical method for dealing with the problem, and is unusually good for burns of the face and neck, likewise, it is of real value in infected burns At the end of ten days, the burns are covered with wet dressings With each exposure of the wound, loose portions of slough are cut away by sterile scissors or scalpel The entire area is again covered by fine-mesh gauze and wet dressings are reapplied This is repeated daily until the slough is entirely removed and the granulating bed is ready for grafting

Chemical Debridement A second method for removing the burn slough consists in the application of pyruvic acid in starch paste A one per cent pyruvic acid paste is liberally applied, and at each successive dressing the burn slough is removed from places where it is easily cut away The pyruvic acid paste produces some pain for a few minutes after its application, but this soon wears away This method has the advantage of quickly separating the more superficial types of full-thickness loss, and having the burned patient ready for grafting between the sixteenth and eighteenth days

urinalysis However, when necessary a patient can be brought in off the street and an emergency procedure undertaken, with just these examinations On the other hand, definitive tumor operations, with occasional exceptions, are relatively elective and a few days spent in preparation of the patient are of the utmost value

It is an often quoted misconception that the growing tumor mass itself depletes the host as it supports its own nutrition This is a small factor in the over-all picture The depletion effected by the tumor is secondary to its interference with the normal function of the various body systems First and foremost of these, as it affects nutrition, might be considered the interference with the passage of food through the gastrointestinal tract Obstruction may be the result of a primary intestinal tumor or it may be secondary to an extrinsic lesion In either case, however, the normal requirement of an adequate and balanced food intake is jeopardized as manifest by weight loss, diminished blood volume, lowering of the plasma protein values, and the like As the obstruction becomes more complete, actual vomiting may ensue, with the production of fluid and electrolyte imbalances as well

Obstructive complications are not solely related to the gastrointestinal tract, however Biliary tract obstruction with its associated hepatic damage can be as serious a preoperative situation as gastrointestinal obstruction Urinary tract obstruction can similarly place a deterrent to extensive definitive management—even to the point of necessitating preoperative decompression Ulceration of the tumor mass results in a new series of problems that, uncorrected, can produce serious operative and postoperative problems Hemorrhage can be either acute, producing shock and even death, or chronic and debilitating Diarrhea secondary to ulceration may also produce fluid and electrolyte problems Infection in the ulcerated area may have both local and systemic effects The latter may manifest itself as septicemia or bacteremia

Pain, frequently a late finding in malignant disease, though it often brings the patient and doctor together, may have been tolerated for a long period of time, while the general nutritional state, to which we must always return, suffered further depletion The drugs used often per se produce enough anorexia to result in malnutrition One of the more dramatic manifestations of dietary insufficiency secondary to ulceration and pain is the markedly depressed prothrombin time often found in patients with extensive intraoral cancer, frequently with lesions of the tongue The immediate implication, of course, is that of severe liver disease Actually, it is secondary in most instances, as the parenteral use of vitamin K restores normal values with great rapidity

Chapter 16

ONCOLOGICAL SURGERY

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THE SURGEON undertaking the management of oncological problems must constantly recall a fundamental concept of his training, namely, that he is primarily a general surgeon who has subsequently received specialized training in the natural history of malignant disease and in our present-day methods of modifying the course of that disease. Though tumors may manifest aggressive growth tendencies which must be met with a similar force, seldom do they confine themselves to one of the various specialty fields. A sound knowledge of general surgical principles is essential, not only during the operative procedure, but also in preparing the patient for operation and guiding him through the immediate postoperative period. A single operation for a specific tumor, no matter what its origin, may entail removal or modification and functional re-establishment of a portion of the gastrointestinal tract, the genitourinary tract, or the vascular and the neurological systems. The problems that might arise in a recovery room where postoperative tumor patients are received, therefore, could be viewed more as a combination of the various specialty problems rather than those relating to an independent and distinct field.

PREOPERATIVE STATE OF THE PATIENT

An operative procedure lasting four to six hours would tax the reserve of the most stalwart individual. Tumor patients are generally far from the enviable position of being stalwart. It has been our concept that anticipation and preparation before the operation are the most effective means of combating postoperative complications.

A critical review of the patient's nutritional state, therefore, is essential preoperatively. One would not consider the administration of a general anesthetic without first obtaining a complete blood count and

bronchioles and alveoli, should be encouraged as soon as the patient is conscious It is obvious that routine aspiration cannot possibly remove secretions except from the upper airway Even careful catheter aspiration reaches only the secretions in the major pulmonary radicles One must rely on coughing, deep breathing, and normal ciliary action to move the secretions from the peripheral position centrally to a point where they can be eliminated

Circulatory Homeostasis

Intravenous Infusion When a major tumor operation is completed, there inevitably is at least one intravenous infusion running, often through a polyethylene catheter placed with the "cut-down" technique It is imperative that this be maintained not only for basic fluid requirements, but also for sudden use if hemorrhage occurs

At the conclusion of the operation, the surgeon and his resident should determine what subsequent fluids will be needed Blood lost should be replaced when possible during the operation, but if this has not been accomplished it should be done as soon as surgery is completed In general it is planned that the patient will receive 2000 to 3000 cc of 10 per cent invert sugar in water during the first twenty-four-hour postoperative period When there have been abnormally high losses or when the urinary output is abnormally low, this will have to be modified Certain patients who are poor cardiac risks require slow administration of fluids (30 to 40 drops per minute) In general, replacement blood is given at about 60 drops per minute, other fluids, unless containing potassium or calcium, are given at a somewhat more rapid rate

Intake and Output It is imperative that an accurate record of intake and output be set up immediately postoperatively Only by accurate measurements can the complications of over or under compensation be avoided

Blood Pressure, Pulse and Respiration Careful evaluation of the blood pressure, pulse and respiration should be followed until the patient has become stabilized at approximately the preoperative level This single series of interpretations can be one of the most important, as it gives information as to the adequacy of the airway, the fluid replacement, and possible hemorrhage

Sedation and Analgesia

Sedation is one of the most difficult subjects to discuss in general terms Strictly speaking, analgesia, or the relief of pain, is specifically what is desired and sedation per se should be negligible In common

Our discussion has emphasized the varied manifestations and symptomatology which may be associated with tumors, and, at the same time, the multiple deficiencies and discrepancies from the optimum preoperative state that may result Corrective measures are not peculiar to the field of oncology and require no special enumeration except to re-emphasize their importance The single feature that does make them unique is that, at best, corrective measures are temporary, since the disease itself is progressive Under these circumstances, many days to weeks cannot be set aside preparing the patient for definitive management The intensive therapy concept, so apt in the recovery room, applies both before and after the operation in the treatment of tumors

GENERAL CONSIDERATIONS IN POSTOPERATIVE THERAPY

The postoperative period begins when the wound is closed, the dressings have been applied, and administration of the anesthetic agents has ceased Immediately there are the following considerations respiratory exchange, circulatory homeostasis and sedation

Respiratory Exchange

OXYGEN Oxygen should be available for use when cyanosis or tachycardia occurs It should not be used routinely as it encourages shallow respirations and favors the collection of secretions in the peripheral bronchioles While oxygen tents are comfortable enclosures for a patient in hot weather in the absence of air-conditioning, they are the least effective method of administering oxygen when it is specifically needed Either the mask or nasal catheter technique is considerably more effective in producing adequate volume concentration Further, there is the subconscious tendency once the tent is set up to leave the patient alone and not disturb the mechanical features of the apparatus These patients should be turned and moved frequently, which, at best, is difficult in a tent Oxygen is usually administered by the mask or catheter technique at the rate of about 6 to 7 liters per minute

ASPIRATION OF UPPER RESPIRATORY PASSAGES Frequent aspiration of the upper respiratory passages is of vital importance This can be effectively accomplished only with a mechanical aspirator when the secretions are thick Oozing from the intraoral suture line may present additional material within the air passages When the foot of the bed or cart is elevated, the forces of gravity can act in such a manner that the secretions will collect in accessible areas rather than trickle downward into the trachea and bronchi in the semiconscious patient

DEEP BREATHING Deep breathing, to allow aeration of the terminal

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surgical parlance, however, the term "sedation" has lost its strict pharmacological meaning, and it generally is applied to the use of drugs which have both analgesic as well as sedative properties, with emphasis actually on the former *The complications of oversedation are much more severe than those of undersedation*

After the patient is fully conscious, 75 mg of Demerol are given every six hours as required for the relief of pain This dosage would be utilized for a relatively healthy middle-aged man who had had an abdominal or thoracic operation Many tumor patients are in an older age group and will tolerate only much smaller amounts of narcotics It should also be emphasized that the order for the analgesic is not for "pain or restlessness," but only for "pain" Restlessness is often a manifestation of anorexia, which further sedation would only complicate Routine orders for sedation to allay restlessness should be avoided Medication should be administered on the individual basis under these circumstances and then only after the integrity of the airway and the absence of hemorrhage have been established

SUMMARY OF GENERAL MEASURES

1 Administer oxygen as required
2 Aspirate the upper respiratory passages frequently
3 Encourage deep breathing
4 Continue present intravenous fluid
5 Give more intravenous fluid in amount and rate as directed
6 Maintain a record of intake and output
7 Check blood pressure, pulse and respirations every fifteen minutes until they are stable
8 After the patient is fully conscious, give an analgesic, as ordered, when required for the relief of pain

SPECIFIC CONSIDERATIONS IN POSTOPERATIVE THERAPY

In addition to the general considerations which have been discussed, certain specific considerations, dependent on the anatomical area involved, require special mention in multi-organ excisions for tumor These sites include the head and neck, the chest, abdomen, and extremities

Head and Neck

Massive resections in this area include the excisions and dissections in continuity for intraoral disease combined with neck dissection, either unilateral or bilateral, tracheotomy is routinely performed to assist in the postoperative care Total thyroidectomy or total laryngectomy is fre-

quently combined with neck dissection In the latter instance, partial pharyngectomy or cervical esophagectomy may be included and the attendant reconstruction requires special attention

The following instructions may be given for the care of patients having massive resections in the neck area

1 Aspirate the tracheotomy opening every thirty minutes or oftener, if indicated

2 Remove the inner cannula of the tracheotomy tube and cleanse it thoroughly twice a day

3 Keep the head of the bed elevated about 30 degrees

4 Give nothing by mouth

5 Give 50 mg Demerol every six hours as required for relief of pain

6 Check dressings frequently for evidence of bleeding

The tracheotomy opening established after extensive head and neck operations requires special care The presence of an intraoral suture line, with the additional secretions attendant thereon, is one of the main reasons for performing a tracheotomy Aspirations must be frequently, but carefully, performed so as to remove the secretions collected but not to traumatize the tracheal mucosa Particular care should be taken to keep the aspirating catheter clean by wrapping it in a sterile towel Careless technique can introduce potentially serious pulmonary infection The coughing produced by the aspiration does as much as any other measure to promote the movement of the secretions from the periphery to a position where the catheter can reach them Therefore, two brief aspirations, with the catheter inserted only about 6 inches, a few minutes apart, are much more effective than one prolonged one The inner cannula must be removed at least twice a day and cleansed thoroughly by boiling and brushing In spite of the various humidifying agents, crusting along the tube is bound to occur Should the main tube become dislodged from its position in the trachea, the dressings must be removed immediately and the tube replaced A Mosher lifesaver, devised in the days of prevalent diphtheria, can occasionally be a lifesaving instrument quite literally, as it can often be passed transorally and attached to oxygen for temporary restoration of the airway In most instances, however, the patient can breath temporarily through his mouth or nose, so that an orderly restoration of the tube to its proper position is possible

Usually tracheotomy is omitted with total thyroidectomy This is particularly true if both recurrent laryngeal nerves have been carefully identified and preserved, and if both cords are noted to function at the time of extubation These patients must be watched for the development of

postoperative edema which may obstruct the airway A basket containing the kit necessary for the performance of a tracheotomy is left at the bedside One other feature of the postoperative period following total thyroidectomy which must be kept in mind is the possibility of the development of tetany secondary to the removal or nonfunction of the parathyroid glands An ampule containing 1 gm of calcium gluconate in 10 cc of sterile water with an appropriate needle and syringe is kept at the bedside of these patients for intravenous use should the occasion arise

The neck dressings, which are applied with a certain amount of gentle even pressure when the majority of the main venous channels have been removed, invariably produce some duskiness of the head accompanied by variable edema, both cerebral and extracerebral This is minimized by elevation of the head of the bed There is the disadvantage of having the forces of gravity work against keeping the tracheobronchial tree clear of secretions, but a tracheotomy compensates for this to a large degree Progressively, more prominent edema, brachycardia, headache and nausea are symptoms which should alert one to the possibility of an overenthusiastically placed dressing Merely loosening the outer elastic bandage often improves this state

Oral nourishment and medication are prohibited for at least forty-eight hours Most of the patients have difficulty in swallowing, just as they have difficulty in expectorating, and more material will be aspirated into the lungs than will reach the proper destination

Since, as a routine accompaniment of the neck dissection, a cervical plexectomy is performed, there is little real pain following most of these operations and sedation can be kept at a minimum *The alert patient has a much clearer tracheobronchial tree than does one who has had analgesics or sedatives*

Finally, with the division of a number of major vessels, the danger of sudden, rather massive hemorrhage is constantly present In this particular anatomical site, its occasion is usually obvious and likewise its control by direct pressure, until more definitive management can be undertaken, is the most expeditious one

Chest

In this country, radical mastectomy has long been accepted as the standard form of treatment for carcinoma of the breast More recently, internal mammary node dissections have been included in certain selected patients Excision of portions of the chest wall as well as mediastinal node dissections is frequently added to the excisions of pulmonary parenchymal disease

In general, following tumor surgery involving the chest, the following instructions apply

1 Check the chest catheter and water seal at least every hour
2 Turn the patient frequently
3 Aspirate the tracheobronchial secretions frequently

If pneumonectomy has been performed, of course, no chest catheter is in place Otherwise maintenance of an adequately functioning catheter is essential for the rapid re-expansion of the lung and the persistence of this state If there is any question of adequate expansion, careful physical examination and roentgenological study are in order Turning the patient frequently will tend to minimize the complications of atelectasis, as will frequent and careful tracheobronchial aspirations

Heavy sedation in this group of patients also is fraught with the potential of serious complications There is a rather significant amount of pain to be expected, however, unless intercostal nerve blocks have been performed in the operating room The practice of performing nerve blocks should be encouraged

Abdomen

Multi-organ excisions for neoplastic disease in the abdomen include not only one major system with its associated node groups, but occasionally multi-system excisions or modifications as well Operations in the upper abdomen may include the stomach, esophagus (which often also involves a thoracic incision), colon, pancreas, spleen and liver, while those in the lower abdomen may include the colon, bladder, uterus and small bowel, as well as segments of major arteries In either site, portions of the abdominal wall may have to be sacrificed While the majority of these patients have their more critical periods a few days after the operation, when the function of the gastrointestinal tract is in the process of restoration, some crises are peculiar to the recovery room period For these, again should be emphasized the original general orders mentioned earlier The blood pressure, pulse, and respiratory rate must be meticulously followed since hemorrhage is not likely to be visible Oozing from large surfaces denuded of peritoneum during extensive dissections is a potential hazard that may last for days and can diminish the circulatory blood volume considerably Fluid balance sheets must be accurately kept as these patients often will be maintained with gastric suction for some days

Specific additional orders generally are

1 Irrigate the Levin tube with 25 cc of physiological salt solution every hour

2 Examine any exteriorized tissue in one hour and then every six hours for viability

Intestinal decompression is dependent on adequate functioning of the gastric suction tube This is vital not only for the removal of intestinal secretions, which may try the integrity of the various suture lines, but for the removal of swallowed air, which accounts for over 90 per cent of intestinal gas The use of physiological salt solution for irrigation is preferred so that as little electrolyte as possible is rinsed out Adequate functioning of the tube is also important in the prevention of the distention of the abdomen and the consequent diaphragmatic elevations and subsequent atelectasis

Exteriorized loops of bowel, either as a part of the gastrointestinal tract per se or as a substitute bladder, must be examined frequently to ascertain the integrity of their blood supply Occasionally, the wound of exteriorization may be too tight and early modification may prevent gangrene Sometimes the tension on the loop is too great and can be modified Finally, if gangrene does develop, emergency correction is immediately indicated

Extremities

Major excisions of the extremities include not only amputations, but quarterectomies as well For these the general orders mentioned are usually sufficient, since the most serious immediate complication is shock due to inadequate blood replacement or postoperative hemorrhage Since the major body functions of ingestion and excretion are minimally affected, it is not uncommon to witness a rather "poor-risk" patient tolerate these major excisions quite well

GENERAL POSTOPERATIVE AXIOMS

At the risk of repetition, a few pertinent concepts upon which the individual responsible for the postoperative care of patients subjected to major tumor surgery might reflect are summarized

1 There is always more blood lost than you think

2 A clear airway is half the immediate postoperative battle

3 Sedation is for pain, not restlessness, keep it at a minimum

4 A good dressing covers the wound adequately with even pressure, but does not strangle the patient or inhibit desirable activity

Chapter 17

OBSTETRICS AND GYNECOLOGY

JOHN W PAYNE, M D, and JOHN WOLFF, M D

THE TWO MOST DANGEROUS HOURS in a woman's life are the first hour after her birth and the first hour after she gives birth to a child Continuous care is a positive necessity during these critical periods It is paramount that all the means to care for the mother and newborn infant be immediately available

In dealing with both obstetrical and gynecological patients, a fundamental principle must be kept in mind, and that is that a woman, as such, regardless of the severity of her illness or the crucial aspect of the surgical procedure, always needs love, comfort, and a devotion to her as an individual This should never be forgotten!

The gynecological surgery of today is becoming increasingly more serious and more extensive, and it is also more intricate and delicate in character Not only does this call for the perfection of excellence in surgical technique, but also for the intelligent management of the minutest details of preoperative and postoperative problems

Adequate records are of extreme importance They are not only of importance for future surveys and study, but actually provide a play-by-play description of the patient's progress To be of value the record has to be simple, uniform for the particular hospital, and kept up to the minute

Attention to the details of fluid balance, blood replacement and cardiac and pulmonary problems is the same as applied to all other surgical problems The more specific gynecological conditions will be discussed individually

Since most gynecological procedures are essentially elective in nature, one must take the time for a thorough preparation of the patient A detailed history may elicit evidence of drug idiosyncrasies, cardiac defects, or a poor

reaction to stress Preoperative study and preparation should be complete and made without haste

The postoperative emergencies are essentially those of shock, hemorrhage and the results of urinary injuries Anesthetic accidents and cardiac, vascular and pulmonary complications may be encountered any time

Each individual, whether physician, nurse, technician or anesthetist, must be alert to his or her responsibility and action during an emergency Assigned duties pertaining to necessary laboratory tests, blood transfusions, intravenous therapy, anesthesia and surgical assistance must be well understood It is imperative that each person have the know-how to aid in any of the needed steps The attending physician must recognize not only the need of his leadership, but must honestly know his own limitations so as to obtain consultation and help before trouble develops

Obstetrical Therapy Room

The need of close observations during the postdelivery period (fourth stage of labor?) is well recognized Yet it is only recently that the recovery room principle has been applied to obstetrics The philosophy of recovery room care is equal in importance to its physical organization This latter quality is dependent upon the size and scope of the maternity division The essential point is to see that all measures to treat emergencies intensively are always ready for action

The obstetrical department is perforce an independent unit within the hospital Both its physical attributes and personnel are in a sense isolated from the general hospital facilities It becomes necessary to duplicate the aspects of the general intensive therapy room within the obstetrical department

The recovery ward should be located within the surgical obstetrical suite This not only conserves personnel, but makes an emergency return to the operating table a simple process

It should be remembered that the major battles will be against shock and hemorrhage Aid for the early detection of both should be on hand More than enough material to combat them should be ready in case of need

An unfortunate fact about obstetrical emergencies is that they take place at any hour of the day or night During certain hours the nursing shortage is evident, laboratory technicians may not be available, and number of members of the house staff on duty may be inadequate, yet preparation must be made for such events Careful thought leads to proper well-planned action Planning for an emergency changes the character of an emergency to that of a routine event

The room itself should be simple in design and its use limited to the observation and care of patients demanding immediate intensive treatment

Necessary diagnostic equipment is to be placed where it is readily noticed Cabinets and drawers should be properly labelled as to their contents Therapeutic equipment must be conveniently located Labels must be plain and easy to read

Gynecological Therapy Room

The gynecological recovery room should be a part of the general surgical recovery room The physical characteristics, equipment and personnel needed have already been adequately discussed

NORMAL OBSTETRICAL DELIVERY

The intensive therapy room is not designed to care for the woman in normal labor, yet, the principle behind the intensive treatment regimen is ideally suited to her The variations of eutocia and the slight changes that can turn labor into dystocia are so finely drawn that almost constant observation is necessary

On the patient's admission to the obstetrical floor, a note should be made of her general condition It should be made certain that she does not harbor an infection which could be spread to others The temperature, pulse and respirations should be checked The ears, nose, throat, lungs and skin should be examined, with the possibility of infection in mind The physician in charge of the patient should always determine her blood pressure himself Severe toxemias are often incipient at the onset He should reexamine her heart for possible abnormalities Note should be made of the character of the uterine contractions during the course of this first examination The position of the baby should also be determined and note made concerning engagement of the presenting part The fetal heart tones should be listened for and the findings recorded The patient should be reassured concerning her labor and eventual delivery

A careful, gentle rectal examination is then made The external genitalia are inspected Note is made as to presence of bleeding or discharge, the station and exact position of the presenting part, the dilatation and effacement of the cervix, and whether the membranes are intact or ruptured The uterine contractions are observed carefully Their intensity, duration, painful character and the interval between them are noted

After the admission examination has been completed, treatment directed to easing labor is instituted, preparation for delivery is made, and watch is maintained for signs of any abnormality

The patient is made as comfortable as possible Unless labor has progressed too far, the time-honored, hot soap suds enema (1 quart) is given This is essential for comfort, it increases the uterine contractions and leads to a clean delivery The oral administration of fluids and food is best

withheld completely, unless labor becomes desultory or is prolonged An empty stomach simplifies the anesthetic problems Analgesia will vary with the patient, her labor and the experience of the obstetrician. Favorites should not be played The physician should become experienced in all methods He should give the analgesic best suited to all the conditions present at the time The husband or one member of the family should stay with the patient until labor is well advanced Continued observation by the physician is most urgent The uterine contractions should be noted carefully, the fetal heart tones listened to frequently, the pulse felt, dehydration and exhaustion watched for, rectal examinations made as little as possible, and the confidence of an easy labor maintained while being on the alert for a difficult one

As labor advances, the patient is taken to the delivery room Constant attendance is maintained Observation of the uterine contractions, the fetal heart sounds, the position of the baby and the cervical changes is continued The personnel needed at the time of delivery are alerted Check is made of the delivery room Is the incubator warm and ready? Is there sufficient oxygen in the oxygen tank? Are blood plasma and fluids available? Are the tracheal catheters and uterine packs handily located? What is the patient's Rh status? Should the newborn's blood be studied at birth?

During delivery the obstetrician should be gentle, careful and as conservative as possible Blood loss should be kept to a minimum If possible, birth should be allowed to take place spontaneously, but, should an emergency arise, the obstetrician must act quickly and skillfully, remembering that the anesthetist is his friend Regardless of the simplicity of the labor or type of anesthesia, a record should be kept of the patient's pulse rate and blood pressure The baby is the obstetrician's second patient It should be kept warm, it should be made certain that the air passages are open and that respiration is established The infant is examined for abnormalities, the cord is cared for and appropriate prophylactic therapy is applied to the eyes It is made certain that the hospital's procedure of baby identification is carried out

During the most serious and dangerous time for the mother, the immediate puerperium, close watch is maintained Constant attendance is kept for two hours

OPERATIVE OBSTETRICAL DELIVERY

Preparations for Vaginal Procedures

When abnormalities develop during labor and operative vaginal pro-

cedures, such as Dührssen's incisions of the cervix, mid-forceps operations, breech extractions, version and extraction, or destructive operations on the newborn, become mandatory, preoperative preparations are of great importance. Although the decision for this type of surgery must often be made at the moment, it is important that the obstetrician remains calm and reviews carefully the diagnosis, indications, conditions present and possible contraindications before proceeding. Once the decision has been made, the obstetrician must act with gentleness, precision and exactness.

The ten commandments which must be followed prior to any serious obstetrical operation are as follows:

1. Provide rest. If the need for interference is not too immediate, a period of rest often does wonders for the mother and the infant. Morphine (1/2 grain) will provide four hours of rest. Nisentil (60 mg.) will give two hours of sleep. No analgesics or sedatives should be given if the infant is in distress or if immediate delivery is necessary.

2. Prevent dehydration and keep a vein "open," in case this is needed later, by giving 1000 cc. of 5 per cent glucose in water intravenously, slowly, while the patient is resting. In all emergency operative deliveries, intravenous fluid therapy is started at once.

3. Record pulse rate, blood pressure and respiration rate, as in all surgical procedures.

4. Give oxygen. Oxygen inhalation to the mother helps both her and the baby.

5. Give atropine (1/150 grain) prior to the administration of any general anesthetic.

6. Check hemoglobin value and erythrocyte count.

7. Have one pint of blood available for transfusion.

8. *Obtain help.* There should be someone to take care of the anoxic baby while the obstetrician cares for the mother, someone to crossmatch and prepare blood, a trained assistant or an experienced nurse to aid the obstetrician.

9. Survey the operating room to make certain that every means to counteract any emergency—oxygen, warmed incubator, uterine pack, tracheal catheters, plasma, fluids, blood—is in readiness.

10. Review the contemplated operative procedure mentally. Re-examination should be made to check on the diagnosis and existing obstetrical conditions.

Following delivery, the obstetrician should never fail to examine carefully his patient for possible uterine rupture or uterovaginal lacerations.

Preparations for Cesarean Section

ELECTIVE CESAREAN SECTION When the cesarean section is an elective procedure the following should be done

1 Review the indications for this elective planned operation Re-examine the patient with this in mind Study the x-ray film (flat plate of abdomen) for fetal development and maturity

2 Check the blood status (erythrocyte count and hemoglobin level) Have 1 pint of blood crossmatched and ready in the operating room

3 Insure the patient a good night's sleep

4 Order a mild warm enema to be given in the morning to cleanse the rectum

5 *Give atropine (1/150 grain), to dry nasal and oral secretions, fifteen* to thirty minutes before operation

6 Give no food or fluids by mouth twelve hours before operation

EMERGENCY CESAREAN SECTION In emergency cesarean section the following are carried out

1 Review the indications and conditions Re-examine the patient in the operating room Perhaps the obstetrical conditions have changed and vaginal delivery might be preferred Obtain an x-ray film of the baby, if one has not already been made, to be certain of normal bony configurations (anencephalic or hydrocephalic?) Check the fetal heart tones

2 Check the blood (erythrocyte count, hematocrit reading, hemoglobin value) Have 1 pint of blood crossmatched and ready Have more blood on hand

3 Start intravenous infusion of 1000 cc of 5 per cent glucose in water slowly

4 Give atropine (1/150 grain) to dry nasal and oral secretions

5 If the stomach is not empty, determine whether or not gastric lavage is in order

6 Secure sufficient help—surgical assistants and an experienced clinician—to care for the newborn

7 Check operating room (oxygen, heated incubator, suction machine, blood, tracheal catheters)

8 Re-check the patient s condition—pulse, blood pressure, skin characteristics

9 Determine whether the choice of anesthesia fits the needs of the baby as well as the mother

10 Give oxygen to the mother while preparation is being made for surgery This also helps the baby

Proper planning and careful attention to details may change an emergency operation to a simple elective procedure One should act quickly, but without haste

MEDICAL COMPLICATIONS DURING AND PRECEDING OBSTETRICAL DELIVERY

The existence of a medical disease during pregnancy often complicates both the pregnancy and the disease process itself The obstetrician needs the help of the internist, the internist needs the obstetrician, the patient needs both the obstetrician and the internist

Cardiac Disorders

Cardiac disorders usually respond better to conservative obstetrical procedures than to radical attempts at delivery It is advisable to have the medical consultant present at the time of delivery He can pick up the finer changes denoting impending cardiac failure or lack of reserve The obstetrician will then be in a better position to start emergency management of sudden cardiac failure

In general, analgesia during the first stage of labor, oxygen inhalations as needed, and termination of the second stage of labor rapidly and easily, with the patient under local or nerve block anesthesia, comprise the procedure of choice The third stage of labor is particularly dangerous to the cardiac patient It is important that blood loss be reduced to a minimum

The vascular system should not be overloaded with intravenous fluids or blood, yet, careful observation should be made for the earliest signs of impending shock and treatment to combat it should be instituted early

Pulmonary Lesions

Pulmonary lesions associated with pregnancy, such as tuberculosis or pneumonia, demand careful appropriate antibiotic and auxiliary treatment of the pulmonary condition and conservative obstetrical management Management during labor and delivery should be similar to that of the cardiac patient

Anemia

Anemia can become a hazardous entity for the patient approaching delivery Complete hematological study to determine the exact diagnosis is imperative Erythrocyte count, leukocyte count, and hemoglobin and hematocrit determinations should be made The sickling phenomenon should be looked for in all Negro women Bone marrow analysis should be made if indicated

When the hemoglobin value is above 8 gm. and the erythrocyte count is above 3,000,000 per cubic centimeter, blood should be available for transfusion. The patient is treated with iron medication (5 grains ferrous sulfate, three times daily) and given a high protein diet as long as possible before the onset of labor. The blood levels are rechecked during labor and following delivery. Blood transfusion is given if too much blood is lost or hemoglobin levels drop below 8 gm. or the erythrocyte count goes below 3,000,000 per cubic centimeter.

When the hemoglobin value is below 8 gm. and the erythrocyte count is below 3,000,000 per cubic centimeter, enough blood (1 pint daily) should be given to bring the patient's hemoglobin value and erythrocyte count up to these levels, where it should be maintained. Iron medication and a high protein diet are given. Blood loss is prevented during labor. Observation and treatment are continued in the puerperium.

Diabetes

Diabetes presents a special problem during pregnancy. Since the babies of diabetic mothers are often extremely large and obese, abnormalities in labor are very common. Some obstetricians advocate cesarean delivery at the thirty-seventh or thirty-eighth week of pregnancy, especially if there is a bad obstetrical history. If a trial of labor is preferred, conservatism should not be overtaxed.

The diabetes must be controlled enough to prevent ketosis and acidosis. Before section, or during labor, the intravenous administration of glucose, with adequate insulin injection to compensate, helps the baby as well as the mother.

Prolonged labor and postpartum hemorrhage are both to be feared and prevented. In severe diabetics, cesarean section should be favored, as well as accurate treatment of the diabetes.

Renal Disease

Renal disease, especially nephritis, is extremely serious during pregnancy. Routine urinalysis and blood pressure determinations are all part of each prenatal visit. At the first sign of renal failure, the uterus should be emptied, since this is the only chance of saving the patient. The hydremia of pregnancy increases the load placed on the kidneys. When it becomes too much for the kidneys, the pregnancy must be terminated or both mother and baby will be lost. Consultation should be sought to aid in determining when the point of no return has been reached.

In all medical complications of pregnancy, consultation is the order of the day.

IMMEDIATE POSTPARTUM PERIOD

Care Following Normal Delivery

Good postpartum care demands constant supervision for two hours following delivery Every parturient is a candidate for postpartum bleeding or shock due to an unrecognized complication of delivery or anesthesia Trouble is to be expected and looked for

On admission to the recovery room, the labor record should be brought up to date so that the attendants will have a summary of the patient's previous health status, pregnancy, labor and postdelivery condition

The patient's general condition is observed The skin color and texture are noted Temperature, pulse, respirations and blood pressure are checked The position and character of the uterus are determined The vaginal bleeding and vulvar wound areas are observed Rechecks and records are made at five-minute intervals for one hour and at fifteen-minute intervals during the second hour

When patients have received a surgical-plane general anesthetic, observation should be made of the air passages One should beware of attempts at vomiting and have aspiration (suction) equipment at hand

When the patient has completely awakened from her anesthesia and the two-hour observation period has passed, she should be checked once more for any evidence of bleeding or incipient shock before she is removed to the lying-in area

The essential nature of postoperative obstetrical care, following the two-hour, postdelivery emergency period, is that of keeping the patient comfortable while allowing for normal involution, wound-healing, and the development of lactation Early ambulation permits spontaneous and complete bladder evacuation, improves gastrointestinal tonicity, and, to a large extent, prevents serious thromboembolic phenomena The patient should be allowed to be up and about as she desires She should not be forced to be too active, yet not allowed to spend too much time flat on her back During the course of this lying-in period, observation should be made for the early signs of sepsis, secondary bleeding, phlebothrombosis and breast complications Ordinarily, the lying-in period is a cheerful one The mother rests in a happy environment She has an excellent chance to become acquainted and psychologically adjusted to her new child She will go home happy, with anticipation and without fear of the future The modern management of pregnancy, labor and the puerperium should leave the mother not only looking forward to the care and development of her newborn, but to a future return to the hospital for a repeat performance Today

the safety of childbearing depends upon the obstetrician He should be ever alert to the incipient onset of the major complications of pregnancy, should detect them early, and treat them at once with courageousness and thoroughness

Care Following Operative Delivery

Care of the surgical obstetrical patient is similar to that rendered to the postoperative gynecological patient Recovery from anesthesia, the prevention of shock and an eagle eye pointed toward the detection of the complications of both obstetrics and the surgical procedure are the general principles of management

Each patient must be attended and watched until she is completely awakened from her anesthetic It should be ascertained that the air passages are open Oxygen should be available and ready for use The suction apparatus should be kept handy in case of uncontrollable vomiting

In the same manner as the patient is observed for two hours following the normal delivery, she should be observed in this potentially serious situation Temperature, pulse, respirations and blood pressure, condition of skin, abdomen, uterus and wound area, and vaginal bleeding should be checked and recorded almost continuously, as previously suggested—every five minutes during the first hour and every fifteen minutes during the second The patient should not be left until her postoperative condition has become stabilized Then, and only then, is the emergency observation period over

The specific management during this period is dependent upon the presence of any complicating factors which might develop

COMPLICATIONS

Postpartum Hemorrhage (Fig 1)

Postpartum hemorrhage is the most dangerous complication of the immediate puerperal period Also, it is the most common of all critical obstetrical emergencies One must be ready for it The cardinal principles—stop the bleeding, prevent shock, replace lost blood—must be remembered

In most instances, postpartum hemorrhage starts in the delivery room It is due to an atonic uterus, retained placental tissue, lacerations of the birth canal, or abnormalities in the blood-clotting mechanism Although this bleeding cannot be predicted, one must always be ready to control it An overly distended uterus (twins, hydramnios, fibroids), anemia, placenta praevia, premature placental separation, and difficult surgical obstetrical maneuvers should alert the observer

When vaginal bleeding starts the bleeding should be stopped and treatment to combat shock instituted

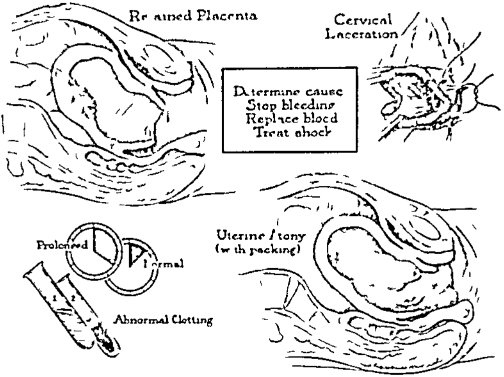

Fig 1 Postpartum hemorrhage

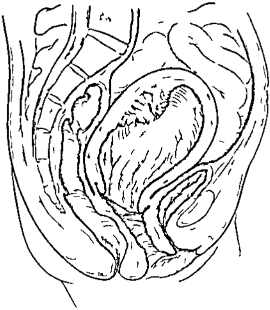

Fig 2 Retained placenta

Arrest of Hemorrhage and Treatment of Attending Shock *When the Uterus Is Soft* If the uterus is soft, boggy and difficult to feel abdominally, the following measures should be taken

1 Massage the fundus
2 Give 1/320 grain ergotrate intravenously
3 Give 1000 cc of 5 per cent dextrose in distilled water, to which 10 minums of Pitocin have been added, intravenously, at the rate of 1 drop per second
4 Return the patient to the delivery room Give sterile preparation Administer an anesthetic as indicated Explore the uterus for retained placental products
5 Pack the uterus if bleeding persists
6 *Treat shock*
 a Carefully observe blood pressure and pulse, check skin for coolness and clamminess
 b Crossmatch blood at once Make certain that enough blood is available Watch the Rh factor
 c Place 5 cc of patient's blood in a test tube Observe the clotting mechanism
 d Give plasma or dextran intravenously Omit Pitocin if the uterus has contracted, give it simultaneously with the fluid if the uterus has not already contracted
 e Give adequate blood transfusions Estimate the blood loss and give enough blood to replace this

When the Uterus Is Firm When the uterus is firm and remains firm, in spite of persistent bleeding, the following measures are taken

1 Return the patient to the delivery room
2 *Search for birth canal lacerations* Examine the clitoris and urethral

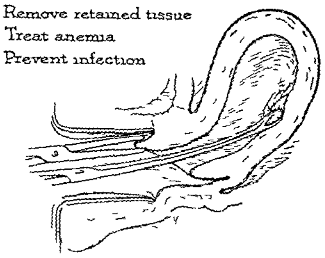

Fig 3 Treatment of postpartum hemorrhage due to retained placental tissue

areas, vaginal lacerations, episiotomy extensions, and cervical lacerations
3 Place sutures at once, as indicated
4 Pack the vagina
5 Beware of hematomas into the broad ligament, ischiorectal fossa and the perivaginal fascial spaces
6 Treat shock and replace blood loss at once

RESTORATION OF NORMAL BLOOD-CLOTTING MECHANISM In the presence of severe bleeding, premature separation of a placenta, or the use of excessive amounts of citrated blood, the fibrinogen component of the blood may be depleted suddenly and rapidly This prevents normal clotting of the blood Bleeding will be unsurmountable from any cut surface of the body unless the clotting mechanism is first restored to normal To accomplish this

1 Check the clotting time and clot retraction Place 5 cc of the patient's blood in a test tube Allow this to stand for five minutes A clot should be formed or forming at this time Within ten minutes, the clot should be firm and easily distinguishable When it is not, treat immediately for fibrinogen deficiency
2 Fresh blood, or blood obtained from a suitable donor, will add sufficient fibrinogen to bring the clotting mechanism back to normal Give in liberal measure—at least 1000 cc —and rapidly
3 Give fibrinogen (2 gm dissolved in 50 cc of distilled water), when available, intravenously and rapidly Repeat until reaction to the clot test is normal

TREATMENT OF PROLONGED BLEEDING TIME Blood dyscrasias, especially thrombocytopenic purpura, leukemia and aplastic anemia, may lead to severe bleeding In these conditions the clot will be normal, but the bleeding time is unusually prolonged Blood oozes into subcutaneous areas on slight bruising Small hematomas are present Blood studies will reveal the proper diagnosis Hematological consultation is a necessity Massive blood transfusions will be needed Removal of the spleen in essential thrombocytopenic purpura (bone marrow containing megakaryocytes) will result in a dramatic cure In most instances, however, treatment is purely symptomatic

HYSTERECTOMY For all patients with severe postpartum hemorrhage, one must be ready to perform an emergency hysterectomy as a last resort Delay, however, should not be too long Uncontrollable bleeding, plus a recurrence of shock and the presence of a normal blood-clotting mechanism, is the prime indication

Rupture of the Uterus (Figs 4 and 5)

Postpartum shock and internal hemorrhage mean uterine rupture, unless this possibility has been ruled out by careful intrauterine explora-

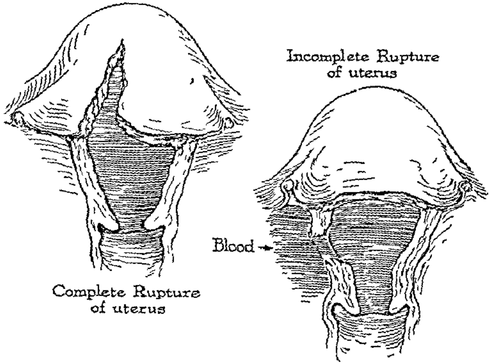

Fig 4 Incomplete and complete rupture of the uterus

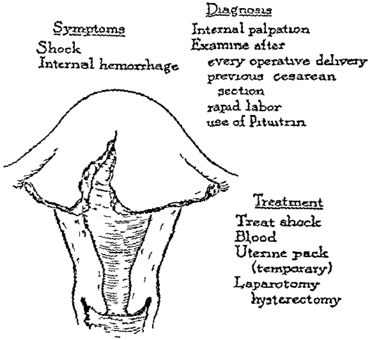

Fig 5 Rupture of the uterus

tion The vagina, cervix and the interior of the uterus must be examined carefully following all operative obstetrical procedures

The possibility of rupture of the uterus should be considered when the patient has an exceedingly rapid delivery, when the uterine contractions suddenly cease during the second stage of labor, whenever suddenly unexplained fetal intrauterine death takes place, when labor is prolonged, or when cephalopelvic disproportion is present Certainly one will be aware of its possibility if the patient in labor possesses an abdominal scar due to a previous cesarean section or uterine tumor removal It is again emphasized that the uterus should always be examined following any major vaginal obstetrical operation

Diagnosis of rupture of the uterus rests on intrauterine palpation, the presence of shock and signs of internal hemorrhage

When this complication is manifest the uterus and vagina are packed as well as possible, adequate blood transfusions are given, and immediate laparatomy is performed, to be followed by a hysterectomy

Inversion of the Uterus (*Fig 6*)

When the uterus is seen to be inverted and the abdominal dimple that replaces the absent fundus is felt, the diagnosis of inversion of the uterus is obvious

The uterus should always be palpated abdominally after delivery It must be at the level of the umbilicus If it cannot be felt, the examiner puts on a sterile glove and searches the vagina, where he will find the inverted uterus

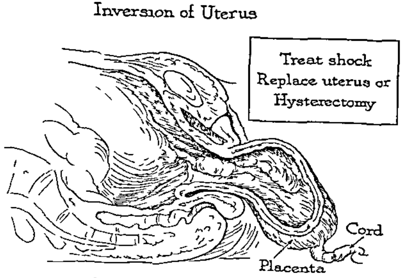

Fig 6 Inversion of the uterus

When the uterus is found to be inverted, if shock is not yet apparent it soon will be, and treatment to combat it should be instituted without a second's delay When shock is under control, and only then, the uterus is replaced manually with the patient under anesthesia If careful observation shows that this maneuver has failed, hysterectomy, either vaginal or abdominal, is in order

Anesthetic Accidents, Cardiac Arrest and Sudden Embolism

At times, these also are obstetrical problems The possibility of their occurrence should be recognized They are treated in the same manner as when they occur following any surgical procedure

Shock

Shock following delivery is usually due to one of the above-described postpartum complications Uterine rupture, broad ligament hematomas, inversion of the uterus, embolism and anesthetic accident are the usual causative agents Yet shock, as a distinct idiopathic entity, may follow a normal delivery as well as a prolonged or difficult operative one Because of this, one must be constantly on the lookout for the incipient signs of early shock When they appear, treatment is instituted at once, but search for the cause is continued

SPECIFIC OBSTETRICAL PROBLEMS

Abortion (Fig 7)

The spontaneous interruption of an early pregnancy usually is quickly and easily terminated, yet an element of great danger is always present Severe blood loss can take place in the matter of moments Control of hemorrhage and the prevention of infection are guides to treatment

An abortion is not truly physiological in nature, and cannot be treated in a simple watchful manner, as a labor in miniature When symptoms, especially bleeding, are mild, one may treat with watchful expectancy, but close observation should be maintained for evidence of developing shock and anemia, and, if a completed abortion does not readily take place, the uterus must be emptied quickly, gently and thoroughly

THREATENED ABORTION The patient with threatened abortion, as such, though she demands appropriate therapy, does not require the services or facilities available in an intensive therapy unit Should the process become one of an *abortion in progress* (imminent abortion), as evidenced by an increase in vaginal bleeding, cramps, and the findings of cervical dilatation, the patient must be transferred to a location permitting accurate and continued observation

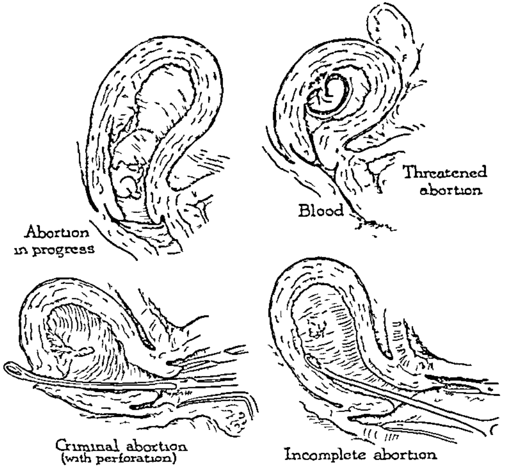

Fig 7 Abortion

Conservative observation and expectancy should be continued in the absence of great cervical dilatation (3 to 4 cm) The following regimen is in order

1 Check present blood levels (red blood cell count, and hemoglobin and hematocrit determination)
2 Watch the bleeding Save all pads, study clots and look for tissue
3 Give 1/320 grain of Ergotrate every two hours for three doses
4 Give intravenous Pitocin drip—1 minim per 100 cc of distilled water, 20 drops per minute has been suggested, and may be of value
5 Give sedation Morphine (1/4 grain) will relieve cramps and often hastens the abortion

Surgical therapy becomes necessary when bleeding and cramps persist in spite of the above measures, whenever brisk bleeding takes place, and when tissue is palpated within the vagina or cervical canal When this treatment is indicated the following should be carried out

1 Re-survey patient's blood status
2 Crossmatch and have 1 pint of blood ready, 2 pints when severe bleeding, anemia, or impending shock is present
3 With the patient under light anesthesia, remove tissue from vagina, palpate the interior of uterus gently and remove any tissue present by finger dissection When this is not possible, remove tissue with a curved placental forceps Use curette only when necessary Pack uterus tightly with 1-inch gauze Remove the packing in twelve to twenty-four hours
4 Continue treatment of shock and anemia with blood or blood substitutions, as needed
5 Reduce infection by the early use of appropriate antibiotics
6 Treat anemia due to blood loss by diet and iron medication

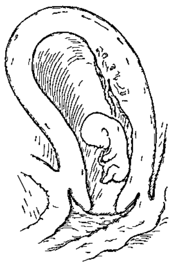

Fig 8 Treatment in threatened abortion

INCOMPLETE ABORTION The term "incomplete abortion" signifies that at least a portion of the gestation product has been passed Bleeding usually has been significant and continues to recur The uterus is not as large as it might be, the cervix is dilated, and tissue often fills the canal

Surgical treatment should be instituted without delay The suggestions mentioned for treatment of an abortion in progress should be followed Study of the patient's blood status should not be neglected and treatment should be given, if indicated

CRIMINAL ABORTION Unfortunately, one must be suspicious of tampering whenever the symptoms of an abortion occur The examiner should carefully question the patient, while examining her, bearing the possibility of tampering in mind

Attempted abortion by the patient with mechanical means usually is ineffective, but it can produce harmful results Vaginal burns with necrosis and bleeding may follow the use of caustic medicaments Perforation of the vagina attended with severe external bleeding or internal bleeding into the pelvic cellular tissue may result from the use of pointed instruments

Instrumental abortion, attempted in a criminal manner, may lead to uterine perforation If perforation takes place near a large vessel, severe intraperitoneal or retroperitoneal bleeding will develop Rapid recognition of this condition, plus treatment of shock and anemia, followed by surgery

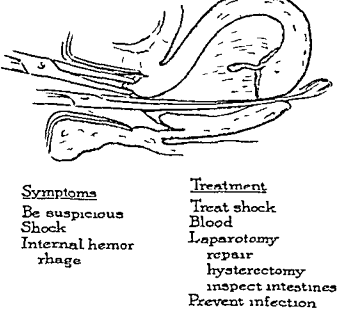

Fig 9 Perforation of uterus in instrumental abortion

(laparotomy) and continued postoperative care is an absolute lifesaving necessity

In criminal abortion, one must always beware of bowel damage This should be treated by surgical repair or resection as needed

Ectopic Pregnancy

The key to successful management depends upon intensive diagnosis followed by intensive treatment Being "ectopic minded," aware of the importance of sudden menstrual irregularities, conscious of the significance of seemingly vague abdominal pains, and adeptness at pelvic examination will hasten a firm suspicion of this imminent pelvic bombshell

Unruptured Ectopic Pregnancy When this is suspected, immediate diagnosis is imperative Only when symptoms and findings are such that suspicions are faintly aroused can one continue observation for several weeks When an early ectopic gestation is highly probable, the patient

should be taken to the operating room at once Examination made with the patient under anesthesia may be of help, but a more exacting procedure is colpocentesis If blood is present, performance of a laparotomy is in order When either no fluid or serous fluid is obtained, further investigation is made by means of either culdoscopic examination or inspection of the adnexa through a posterior colpotomy incision Surgery at this time should not offer any particular danger, and the routine practised in other pelvic laparotomies should be followed

RUPTURED ECTOPIC PREGNANCY Any woman in the reproductive age, having acute abdominal symptoms, requires constant supervision and readiness for serious trouble There is no better place for this than the intensive treatment unit Should any doubt as to the diagnosis of ectopic pregnancy exist, a simple colpocentesis yielding blood will be confirmative The acute abdominal pain, along with signs of shock and internal bleeding, usually points to the source of the emergency

Early diagnosis and rapid treatment save lives The possibility of ectopic pregnancy should be borne in mind and treatment instituted promptly Such a dramatic disease demands dramatic action

Intensive treatment consists of controlling shock, surgery and restoration of lost blood Surgery must not be delayed While the theater is being readied, shock is treated by restoring the blood volume and giving oxygen inhalations At operation, the old principles of "get in fast, ligate the bleeding mesosalpinx, remove the diseased tube, and get out" are still of great value As much blood should be given as appears to have been lost Once the shock state is over, the blood should be administered slowly At surgery, the intraperitoneal blood should be left alone Only enough of it should be removed to provide adequate visualization, the remainder will be absorbed and is of benefit Postoperatively, intensive treatment must be continued Although the postoperative phase is essentially the same as that for any patient who has had a serious operation, the two main dangers involved are in undertreating the existing shock and anemia and in overtreating by giving too much intravenous medication, leading to pulmonary edema and electrolyte imbalance

Pelvic hematoma formation resulting from a tubal abortion or an "old ectopic" demands the same care as any other abdominal pelvic disorder

Placenta Praevia and Premature Separation of the Placenta

Vaginal bleeding in the third trimester of pregnancy is always a serious symptom However mild it may be, this is a warning of trouble ahead Accurate and thorough observation, vigilance and action without hesitation give positive results

In the presence of vaginal bleeding, when the patient is not in labor, the physician should take the following steps

1 Note the patient's general condition for signs of impending shock He should record the pulse rate and blood pressure reading, repeating the determinations frequently
2 Observe and record the fetal heart tones at ten-minute intervals
3 Observe the uterus for irritability and uterine contractions Check the position of the fetus
4 Determine the hemoglobin value, red cell count, hematocrit value and coagulation time
5 Crossmatch 1 pint of blood and see that 2 more pints are available (check the Rh factor)
6 Avoid rectal or vaginal examinations, unless labor begins
7 Have x-ray study made to determine the size and development of the baby, and attempt to visualize the location of the placenta

PLACENTA PRAEVIA This may be diagnosed by the presence of vaginal bleeding, absence of pain, regularity of fetal heart tones, and the fact that no signs of shock appear unless the vaginal bleeding is severe

When bleeding is mild, an attempt should be made to perfect the diagnosis by x-ray visualizations

Before the thirty-seventh week of pregnancy, the physician should

1 Continue observation
2 Replace blood loss via transfusions when necessary
3 Refrain from examining the patient vaginally or rectally
4 When bleeding has ceased, make careful speculum examination of the cervix to rule out the possibility of a cervical lesion or lesions

After the thirty-seventh week of pregnancy, the physician should, after following the above-listed recommendations, make a *sterile vaginal examination* If a *central placenta praevia* is found, cesarean section should be performed When a *marginal or lateral praevia* is present, the membranes should be ruptured and watch maintained

When bleeding is severe it must be made certain that enough blood is available for transfusion Fluids (plasma, dextrose, blood *to combat early shock*) should be given intravenously and preparation should be made for *cesarean section* A sterile vaginal examination is made in the operating room If a *central* praevia is noted, cesarean section should be performed at once, if the *marginal* type of praevia is found the membranes should be ruptured and watch maintained

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The physician should be in readiness, for a patient with mild bleeding and no other manifest complications may suddenly have brisk bleeding and go into shock rapidly There should be enough blood on hand and the surgical obstetrical unit should be on the alert Careful examination should be made at the time of delivery for lacerations Watch of the patient should be continued following labor

PREMATURE SEPARATION OF THE PLACENTA This is a most serious complication It is too often unfortunate for the infant and dangerous to the mother Early recognition and dramatic action offer the only hope

The diagnosis is apparent, it is manifest by mild vaginal bleeding associated with abdominal pains, a tender irritable uterus and signs of fetal distress Too often the onset is abrupt with severe vaginal bleeding, shock and a dead baby Mild symptoms may rapidly assume a malignant character As shock develops, so does an abnormality in the blood-clotting mechanism (afibrinogenemia) with resultant bleeding from exposed vessels

Conservatism, as such, is only warranted when the baby is small (twenty-six to thirty weeks of pregnancy) or when symptoms are mild and there is no sign of fetal distress Nevertheless, intensive observation must be continuous, lest the disease process continue

Action is imperative whenever one notes (1) fetal distress, (2) tetanic uterine contractions without progress in labor, or (3) signs of beginning shock, indicating severe internal hemorrhage Delivery of the baby and placenta must be accomplished rapidly, depending upon the obstetrical conditions present at the time In all cases, it is essential to treat impending shock, give oxygen to the mother in an effort to aid the infant, be ready for possible fibrinogen depletion (have fibrinogen and fresh blood available) and prepare the surgical obstetrical theater

Noting the above precautions, delivery is best terminated by *cesarean section* when the patient is not in labor or the cervix is less than half dilated When the cervix is well effaced or half dilated (5 cm), *simple rupture of the membranes* may be sufficient to hasten delivery Intervention via forceps or breech extraction may be necessary once the cervix is completely dilated and effaced

In all cases, watchful observation must be continued during the operative and postpartum period Preventing and treating shock, observing the blood-coagulating tendency, and carefully noting the contracting power of the uterus are essential to success *Fibrinogen depletion* and the possibility of a *Couvelaire uterus* should be watched for

Again it is emphasized that the import of vaginal bleeding during pregnancy must be recognized One must make the diagnosis early and give treatment rapidly, while using good obstetrical judgment at all times

Nausea and Vomiting of Pregnancy

Both nausea and vomiting are common symptoms of early pregnancy Their exact cause is not known, therefore, their management is somewhat empirical and symptomatic in nature Occurring in about half of all pregnant women, these events are usually mild, but may be the forerunner of a more serious illness

SIMPLE NAUSEA AND VOMITING Simple nausea and vomiting, as such, will usually respond to the following regimen

1 *Small frequent feedings* at two-hour intervals, six feedings daily The diet should be compatible with the patient's desires and idiosyncrasies A forced rigid diet usually produces more nausea and resultant vomiting A free choice of food appears to be the best
2 *Fluids* Copious amounts of water are a must At least one glass should be taken with each feeding and small amounts between feedings Tea, coffee, carbonated beverages and fruit juices may be substituted or added to the water intake
3 *Medication* The efficacy of drugs will vary with the patient New drugs often succeed for a time *Dramamine*, 50 mg , three times a day has proved to be very effective in some instances It causes no side effects, and therefore is recommended for a short trial *Sedation* to ensure a good night's sleep, plus a tendency to relaxation during the day, is important A barbiturate of choice will serve well here *Vitamins B_1 and B_6*, given either by mouth or by injection, may increase the appetite and seem to be of a limited value *Chlorpromazine*, 10 to 25 mg , three times a day offers promise in that it should prevent nausea and vomiting by its action on the central nervous system It is not always effective and can produce side effects (jaundice) Its use should be saved for the nonresponsive patient
4 *Psychotherapy* This is probably the most important part of the treatment The art of medicine entails a knowledge of the patient, her family background, her fears, her problems and the need of a fatherly, priestlike attitude
5 *Careful observation* The simple case may readily become one of marked severity One should beware of persistence of nausea and vomiting in spite of treatment, weight loss, rapid pulse and evidence of dehydration

PERNICIOUS NAUSEA AND VOMITING (HYPEREMESIS GRAVIDARUM) This can usually be prevented by the appropriate attention to treatment of all patients with simple nausea and vomiting When the signs of this disease

become clear, *immediate hospitalization* is in order With our present techniques, the severely ill patient of yester-year should not be seen Abortion, as a cure, is rarely, if ever, needed The deaths of the past should not take place today

The immediate need is that of rest, relief of dehydration and electrolyte balance

In *mildly ill patients* the following measures may be effective

1 *Sedation* Barbiturates given rectally or morphine sulfate (1/4 to 1/2 grain) often will produce eight to twelve hours' sleep and the beginning of a cure
2 *Gastric lavage* Gastric lavage by means of Wangensteen suction will relieve the persistent nausea and aid in obtaining rest
3 *Intravenous fluids* Three thousand cc may be given in the first twenty-four hours—1000 cc of 5 per cent glucose in saline solution and 2000 cc of 5 per cent glucose in water
4 *Vitamin therapy* Vitamin B (thiamine), 200 mg , and vitamin C (cevitamic acid), 100 mg , may be added to the intravenous fluids Deficiencies of these vitamins are common in neglected patients or in those with prolonged attacks There is no need to procrastinate in giving this treatment

The above-outlined regimen is repeated on the second day As appetite develops, fluids and small frequent feedings are given orally The intake and output of fluids are observed The urine is checked daily for albumin, casts and ketonuria (acetone bodies)

In *severely ill patients*, or those not improving with treatment, the following treatment is given

1 Commence the above-outlined regimen of sedation, gastric lavage and intravenous therapy
2 Study the blood levels of sodium, potassium, nonprotein nitrogen and creatinine
3 Check urine daily for albumin, casts and ketonuria
4 Obtain an electrocardiogram to determine any evidence of potassium deficiency
5 Give Ringer's solution, 1000 cc , as a substitute for the normal saline solution
6 If marked potassium deficiency is evident, add 50 mg of potassium chloride to the 1000 cc of Ringer's solution until the electrocardiogram is normal and the potassium and sodium levels reach normal values

7 Remember the continual importance of psychotherapy Consider the use of hypnosis with its post-hypnotic suggestion in stubborn cases

When rapid improvement fails, the possibility of associated conditions, such as acute hepatitis (or even acute yellow atrophy), gallbladder disease, or even central nervous system disorders (brain tumor), should not be overlooked It should be kept in mind that these symptoms often foreshadow an hydatid mole or chorionepithelioma

Psychotherapy, rigid treatment in the mild case and careful observation are the keys to the management of this problem

Eclamptogenic Toxemia

Good prenatal care, and a careful search for the early symptoms, plus intensive treatment once the diagnosis is established, have led to a lessening of eclampsia per se, and a good result in the great majority of cases This has all been accomplished in spite of the fact that the exact etiological basis of this morbid disease which often clouds the latter part of pregnancy is not known

MILD PRE-ECLAMPTIC TOXEMIA The onset of mild pre-eclampsia is usually incipient and manifested by the presence of occult edema, sudden excessive weight gain, generalized edema and mild hypertension (blood pressure, plus 140 systolic or 90 diastolic) Headache, listlessness and dizziness may develop

Immediate hospitalization with complete bed rest is imperative even in an early case The following regimen is instituted

1 *Diet absolute salt restrictions, low sodium and high protein* content The protein question is debatable, some physicians prefer a low protein diet The low sodium and salt restriction seems to be the most important
2 *Increase of elimination through the intestines* Saline catharsis, with 1 ounce of magnesium sulfate, daily
3 Daily weight check and urinalysis for detection of albumin and casts
4 Eye ground examinations, determination of nonprotein nitrogen, creatinine and uric acid blood levels, renal function tests Results of these tests are sometimes of prognostic value

With improvement and the complete abatement of symptoms, merely routine prenatal care is continued, but guard is maintained

If the disease remains stationary the treatment and observations out-

become clear, *immediate hospitalization* is in order With our present techniques, the severely ill patient of yester-year should not be seen Abortion, as a cure, is rarely, if ever, needed The deaths of the past should not take place today

The immediate need is that of rest, relief of dehydration and electrolyte balance

In *mildly ill patients* the following measures may be effective

1 *Sedation* Barbiturates given rectally or morphine sulfate (1/4 to 1/2 grain) often will produce eight to twelve hours' sleep and the beginning of a cure
2 *Gastric lavage* Gastric lavage by means of Wangensteen suction will relieve the persistent nausea and aid in obtaining rest
3 *Intravenous fluids* Three thousand cc may be given in the first twenty-four hours—1000 cc of 5 per cent glucose in saline solution and 2000 cc of 5 per cent glucose in water
4 *Vitamin therapy* Vitamin B (thiamine), 200 mg, and vitamin C (cevitamic acid), 100 mg, may be added to the intravenous fluids Deficiencies of these vitamins are common in neglected patients or in those with prolonged attacks There is no need to procrastinate in giving this treatment

The above-outlined regimen is repeated on the second day As appetite develops, fluids and small frequent feedings are given orally The intake and output of fluids are observed The urine is checked daily for albumin, casts and ketonuria (acetone bodies)

In *severely ill patients*, or those not improving with treatment, the following treatment is given

1 Commence the above-outlined regimen of sedation, gastric lavage and intravenous therapy
2 Study the blood levels of sodium, potassium, nonprotein nitrogen and creatinine
3 Check urine daily for albumin, casts and ketonuria
4 Obtain an electrocardiogram to determine any evidence of potassium deficiency
5 Give Ringer's solution, 1000 cc, as a substitute for the normal saline solution
6 If marked potassium deficiency is evident, add 50 mg of potassium chloride to the 1000 cc of Ringer's solution until the electrocardiogram is normal and the potassium and sodium levels reach normal values

7. Remember the continual importance of psychotherapy. Consider the use of hypnosis with its post-hypnotic suggestion in stubborn cases.

When rapid improvement fails, the possibility of associated conditions, such as acute hepatitis (or even acute yellow atrophy), gallbladder disease, or even central nervous system disorders (brain tumor), should not be overlooked. It should be kept in mind that these symptoms often foreshadow an hydatid mole or chorionepithelioma.

Psychotherapy, rigid treatment in the mild case and careful observation are the keys to the management of this problem.

Eclamptogenic Toxemia

Good prenatal care, and a careful search for the early symptoms, plus intensive treatment once the diagnosis is established, have led to a lessening of eclampsia per se, and a good result in the great majority of cases. This has all been accomplished in spite of the fact that the exact etiological basis of this morbid disease which often clouds the latter part of pregnancy is not known.

MILD PRE-ECLAMPTIC TOXEMIA. The onset of mild pre-eclampsia is usually incipient and manifested by the presence of occult edema, sudden excessive weight gain, generalized edema and mild hypertension (blood pressure, plus 140 systolic or 90 diastolic). Headache, listlessness and dizziness may develop.

Immediate hospitalization with complete bed rest is imperative even in an early case. The following regimen is instituted:

1. *Diet: absolute salt restrictions, low sodium and high protein* content. The protein question is debatable, some physicians prefer a low protein diet. The low sodium and salt restriction seems to be the most important.
2. *Increase of elimination through the intestines.* Saline catharsis, with 1 ounce of magnesium sulfate, daily.
3. Daily weight check and urinalysis for detection of albumin and casts.
4. Eye ground examinations, determination of nonprotein nitrogen, creatinine and uric acid blood levels, renal function tests. Results of these tests are sometimes of prognostic value.

With improvement and the complete abatement of symptoms, merely routine prenatal care is continued, but guard is maintained.

If the disease remains stationary the treatment and observations out-

lined above are continued After the thirty-seventh week the pregnancy is terminated by the simplest method possible for the particular patient

SEVERE PRE-ECLAMPSIA This may have a sudden onset or may develop from a mild case in spite of careful management Headache, dizziness, personality changes, severe hypertension (blood pressure above 170 systolic and 100 diastolic), albuminuria and evidence of lowered renal function give warning of this severe process

The patient is *immediately hospitalized* and the following regimen instituted

1 *Absolute bed rest*
2 *Diet* the same as that employed for mild pre-eclamptic toxemia
3 *Sedation* barbiturates in repeated small doses will lessen tension
4 *Cerebral depressants* 10 cc of 20 per cent solution of magnesium sulfate, to be given intravenously every six hours Veratrum compounds are of debatable value
5 Hypertonic glucose, 10 per cent aqueous solution, to be given intravenously, 1000 cc daily
6 *Check to be maintained of fluid intake and renal output*
7 *Daily survey* of *blood pressure, urinary findings* and *renal function* tests

With improvement, this treatment is continued until the thirty-seventh week and then the patient is delivered by the best obstetrical means

If severe pre-eclampsia persists, pregnancy is terminated Although one should wait until the thirty-seventh week if possible, a golden opportunity should not be lost

ECLAMPSIA This state is signalized by a convulsive seizure, often repeated, followed by coma and too often by death It indicates severe liver, renal and cerebral damage

The following treatment is instituted

1 *During the convulsion* bodily injury is prevented by applying padding and tongue-biting by using tongue depressors The air passages are kept open
2 *Morphine sulfate* (1/4 to 1/2 grain) is given at once and the dose is repeated often enough to keep the patient quiet (every four to six hours) and sleeping
3 *Oxygen* is given
4 A *cerebral depressant*—20 cc of a 10 per cent solution of magnesium sulfate—is given intravenously, slowly (have 2 cc of calcium chloride available)
5 *Observation* is maintained of blood pressure, urinary output and albuminuria Renal function tests are performed at regular intervals

If the patient improves she is given the treatment outlined for severe pre-eclampsia

When there is no improvement and convulsions persist in spite of the treatment, cesarean section is in order Eclamptics often go into spontaneous labor, this should be looked for When this occurs, *rupture of the bag of waters* is indicated, labor is allowed to progress with the patient under sedation Delivery should be accomplished slowly and spontaneously, if possible

As recovery ensues the following regimen is instituted

1 Fluids (3000 cc daily) are given intravenously 1000 cc of 10 per cent glucose in water, 2000 cc of 5 per cent glucose in water
2 *High protein low sodium* diet is given as tolerated
3 *Sedation* is given only if the patient is restlessness
4 Daily check is made of renal output, albuminemia, renal function and blood nonprotein nitrogen and creatinine until normal levels are reached

The best management of the eclamptogenic state consists in detection of the first warning signs, instituting intensive treatment at once, and to emptying the uterus early when treatment fails

Rupture of the Uterus

Rupture of the uterus manifest following delivery and its treatment have been discussed under complications of the immediate postpartum period As was mentioned, following delivery, every operative obstetrical patient should always be examined thoroughly, in order that a ruptured uterus will not be overlooked

Since rupture of the uterus leads to massive internal bleeding, and to shock and death when treatment is delayed or inadequate, diagnosis must be made early Prevention, of course, is the best treatment, and therefore signs of an impending rupture should be looked for

During pregnancy, rupture may occur suddenly in a patient with a weak uterine scar (cesarean section, myomectomy) Severe abdominal pain, shock and evidence of internal bleeding rapidly develop Treatment to combat shock should be instituted at once, and as soon as possible a rapid simple hysterectomy should be performed

During labor the symptoms of an impending rupture should be watched for A restless patient complaining of lower abdominal pain between labor pains, a taut, tender uterus, and a Bandl's ring are all ominous signs Lack of progress during labor should always arouse suspicion Re-evaluation of the patient as to the necessity of a cesarean section is in order When actual

rupture takes place the patient usually notes a sudden, sharp, severe pain Tremendous fetal activity is noted, then silence Uterine contractions cease and the baby is readily palpated Internal bleeding may be sudden and massive or there may be a slow trickle of blood, dependent upon the site of the rupture The uterus and vagina should be packed and the shock treated immediately, then laparotomy is performed and the torn uterus is removed

The Patient with a Previous Cesarean Section

The dictum "once a section, always a section" is followed by many obstetricians This simplifies the problem in that the patient is prepared for surgery in an elective manner Yet, there are many other obstetricians who feel that a good portion of these women can be readily delivered vaginally

When vaginal delivery is considered expedient for a patient who has had a previous cesarean section the following should be done

1 A careful check is made of the indications for the previous section and it is made certain that a similar condition does not exist at this time
2 The postoperative section record is scrutinized to detect any indication toward a weakness in the scar
3 Continuous observation of the patient is maintained as soon as labor begins
4 One must be cognizant of and look for any sign of impending uterine rupture Section must be performed at once, should such a sign develop
5 Following vaginal delivery a thorough examination should be made for possible rupture
6 One must be ready at all times to treat sudden shock and internal bleeding

Before scheduling an elective "repeat cesarean section," an appropriate date for the operation should be selected Too often the baby delivered by planned cesarean section is on the small side A careful review of the patient's menstrual history and of the development of the uterus and the baby as noted during prenatal visits and by x-ray studies, and repeated rectal examinations made while awaiting ripening of the cervix are invaluable aids toward better surgical timing

Sepsis

Puerperal sepsis can and is being prevented An aseptic conscience has been developed The principles and practices have virtually eliminated the severe dread of yester-year

Prevention remains the watchword Cleanliness, attention to details and asepsis throughout the maternity division have accomplished wonders Temperatures must be taken and recorded every four hours Any recorded fever (100° F or higher) should cause suspicion, its cause should be found and vigorous treatment instituted

When sepsis does develop, the patient is isolated from all maternity patients at once The source and location of the inflammatory process is found The patient's resistance is built up The proper and most effective antibiotic is employed The electrolyte balance is watched

The contagion of puerperal sepsis is still a dreaded, yet preventable, entity Immediate isolation of the patient and a review of the possible breaks in technique leading to the infection are in order Personnel taking care of obstetrical patients should stay away from a patient with sepsis *This patient should be kept far removed from the intensive therapy unit*

The seriously ill, severely septic patient, however, needs intensive treatment Consultation with the expert in antibiotics, the internist, the urologist, the surgeon and the vascular expert is of value Teamwork between specialists is a must for such a patient Intravenous fluids, electrolyte replacement, massive antibiotic therapy and local treatment, dependent upon the location of the infection, are all in order Specific instructions will vary with the patient and the intensity of her illness

Pelvic Hematomas

Lacerations within the genital tract during delivery are not uncommon Failure to note these injuries or improper surgical repair can lead to internal bleeding that rapidly dissects the pelvic structures Large accumulations of blood, leading to shock and anemia, are not uncommon

Prevention lies in good obstetrical practices, a search for injuries following all operative procedures and the careful repair of lacerated structures

The pelvic cellular structures may be filled with a large hematoma arising from several sources Rupture of the uterus below the peritoneal surface, large cervical tears, or lateral wall tears of the vagina (episiotomy extentions) may involve good-sized vessels Bleeding may result in dissection between the fascial layers Retroperitoneal masses may fill the pelvis and lower abdomen The vagina can be swollen shut by a large hematoma Lateral vaginal hematomas may point at the inguinal ligament Bleeding into the episiotomy wound usually infiltrates the gluteal region

These large exudates lead to shock and severe anemia, because they, too, often remain unrecognized There is usually an associated persistent amount of vaginal bleeding Needless treatment with oxytoxics and uterine

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urination Prolonged labor, deep anesthesia and operative obstetrics are common forerunners of this condition When urination does not take place within eight hours after delivery, or when the desire is greater than the ability, merely having the patient sit on the toilet will usually effect urination Early ambulation has made urinary retention a stranger to obstetricians When ambulation fails, the patient is catheterized The catheter is left in place for twenty-four hours, then clamped off for several hours at a time Once the desire to urinate develops, the catheter is removed and the patient is permitted to attempt to empty her bladder naturally When prolonged catheterization is necessary, prophylactic broad spectrum antibiotics should be given

ANURIA OR OLIGURIA This is a dreaded symptom It follows severe toxemia and severe shock Urological and medical consultations are urgent Heroic measures are needed at once.

Severe Anemia

A severe anemia occurring during pregnancy is due to abnormal blood formation, blood loss, or increased blood destruction A complete blood examination is necessary This means having a hematologist study the bone marrow cells as well as the peripheral blood

Iron deficiency anemia (hypochromic, microcytic) is the most common type This may be the result of hemorrhagic blood loss, long-continued blood loss, or a severe nutritional deficiency The cause should be determined and removed The blood should be rapidly restored to safe levels by giving transfusions Oral iron therapy and a high protein diet will help in returning the blood to normal levels

Pernicious anemia of pregnancy is rare Repeated transfusions to keep the blood at a safe level, and folic acid and liver therapy are appropriate treatment Recovery follows delivery

Sickle cell anemia must be searched for in all Negro women who are anemic

Good diagnostic methods and observations will reveal the rare *leukemia, purpuras* and allied blood disorders that occasionally are first noted during pregnancy

Postpartum anemia of a severe nature has been noted in 5 per cent of the patients It is due to excessive bleeding at delivery Blood transfusions, to bring the blood to a safe level, followed by a high protein diet and oral iron therapy are needed

BLOOD TRANSFUSIONS IN THE OBSTETRICAL PATIENT No matter how simple a blood transfusion may seem, it is always a major surgical operation Reactions and dangerous complications can be prevented merely by the

massage is too often the rule Proper observation of the postpartum patient will yield an early diagnosis *when treatment is relatively simple* Continued vaginal bleeding or signs of impending shock should alert the observer If the abdomen is palpated, the vulva is inspected, and sterile rectal and vaginal examinations are made, this injury will be immediately detected

Treatment for shock is instituted, blood loss is replaced, and the patient is transferred to the surgical obstetrical room where the blood is evacuated, the bleeding vessel is ligated and the area is packed with absorbable gauze (Oxycel or Gelfoam) It is much better to prevent the lacerations in the first place, and, when they do occur, to suture the bleeding areas properly

Urinary Problems

Early recognition of most urological problems occurring during and after pregnancy simplifies the treatment in most instances Intensive therapy will be limited if seemingly simple anomalies, which are quite common in obstetrical patients, are treated early

SEVERE URINARY TRACT INFECTIONS *Urinary tract infections often* complicate pregnancy and the puerperium Consultation with the urologist is invaluable in that the management of these problems is essentially urological in nature The obstetrician can be of help by recognizing pyelonephritis early in its course Fever alone may be the first warning Microscopic examinations of a catheterized urine specimen will show pus A gram-stained smear of the urinary sediment is easily obtained A culture of the urine should be made so as to identify the involved organism correctly Since *Escherichia coli* is the usual agent, therapy directed to this bacteria should be started at once When the culture results are known (after twenty-four to forty-eight hours), the antibiotic can be changed to fit the responsible organism Flushing the kidneys by giving large amounts of fluids orally (or intravenously, when needed) is still of help Drainage through a ureteral catheter may be needed in stubborn cases Symptoms of *renal and perirenal abscess* should be watched for Anemia can rapidly take place in a patient having a severe infection The blood should be checked frequently

URINARY RETENTION The retention of urine is not uncommon during labor or following delivery A full bladder can be seen at a glance during labor The large balloon-like bulge extending from the symphysis pubis to the umbilicus is certainly visible as is a bulging cystocele in the grand multipara Treatment consists in merely using the catheter frequently

Retention following delivery is due to bladder trauma during delivery, as well as to interference in the *neurophysiological reflex mechanisms* of

Good prenatal care with the encouragment of proper nutrition, the absence of anemia and the early treatment of a toxemia will bring the mother to her labor with the baby in optimum condition *Labor* must be conducted with good obstetrical judgment, with recognition of the need for conservatism and at the same time cognizance that one must be alert to detect impending fetal distress and to utilize appropriate surgical obstetrical methods as indicated Unfortunately, the obstetrician usually has no control over the development of intrauterine fetal distress, but he can and must be ready to treat this at once when it is manifest Early diagnosis and gentleness in surgical technique will minimize the dangers Anesthesia is definitely important to the mother's welfare, but must be utilized so as not to overly affect the baby Antinarcotic drugs (Nalline) and oxygen given to the mother just preceding delivery are invaluable aids

Asphyxia Neonatorum (Anoxia, Hypoxia)

The newborn baby should breathe and cry upon delivery (slow delivery technique) or in seconds following its emergence from the birth canal Any delay in this initial respiration means a depressed infant This respiratory depression may be due to an overabundance of analgesia and/or anesthesia, the trauma of labor and delivery, intrauterine oxygen deprivation, or cerebral damage (hemorrhage)

Asphyxia livida ("blue baby") is indicative of an overaccumulation of carbon dioxide and a lack of oxygen This is usually caused by too much anesthesia, but may be the forerunner of a more severe state It is treated as follows

1 *Rest* Do not lift, spank or handle the infant
2 *Open the air passages* Suction fluid from the nose and mouth
3 *Apply stimulation* by gently stroking the skin, avoid any violent form
4 *Give oxygen*—4 to 6 liters per minute Apply the mask loosely over baby's face

The sleepy baby should respond within three to five minutes If he does not do so, treatment for asphyxia pallida, as described below, is given

The baby with *asphyxia pallida* is anoxic and in shock The treatment is as follows

1 *Be gentle* Do not stimulate the infant in any fashion
2 *Keep the infant warm* Wrap him in warm blankets
3 *Open the air passages* Insert a tracheal catheter about 1/2 inch into the trachea, do this by the method familiar to you, by direct vision

attention to the many details involved in a transfusion procedure The following points should be observed

1 The blood bank is responsible for a careful selection of donors and proper methods of collecting and preserving blood
2 The obstetrician is responsible for careful typing and cross-matching Type specific blood should be employed, unless the urgency requires that a universal donor type be used
3 The patient's Rh factor should be double-checked Rh-positive blood should never be given to an Rh-negative mother
4 Transfusion should be given slowly, unless immediate blood replacement is urgent The patient should be observed constantly for signs of a reaction When doubt exists the transfusion should be stopped
5 It should be remembered that the hydremia of pregnancy will allow for a greater loss of blood before shock ensues than is normally the case, however, one should not become overconfident on this score The need should be judged by the signs of shock and blood level determinations

THE NEWBORN

The first twenty-four hours of life are indeed the most dangerous The severe death-dealing illnesses affecting the newborn child develop during either pregnancy or labor, and demand immediate and persistent heroic care The one individual who must handle this emergency problem is the person who delivers the baby The pediatrician must work with the obstetrician, but in a consultative manner, and in the continuation of care after thorough immediate treatment has been given The acute disorders of the newborn demand complete cooperation between the obstetrician-pediatric teams There is much to be learned in the management of these problems Working together is the first step toward new inroads and advances In this chapter, however, we are primarily concerned with the role of the obstetrician in the management of these problems

The delivery room itself is the intensive treatment room for the newborn Here is where treatment should be started, and the baby should not be moved until its rate of improvement has become stabilized All necessary equipment must be at hand This essentially consists of (1) tracheal catheters and an infant laryngoscope, (2) oxygen, (3) incubator (with temperature and humidity controls), (4) warm blankets, and (5) equipment for performing a blood count, Rh test, Coombs' test and infant blood transfusion

The prevention of tragic illnesses of the newborn lies with the obstetrician

5 Notify the pediatrician so he can commence his care at this time
6 Watch for respiratory difficulties, and treat as they occur

The use of these simple measures alone will do much to give a premature infant a good start

Erythroblastosis

Although this, too, is in reality a "pediatric" condition, the obstetrician has much to contribute towards its successful management Rh-factor determinations are now routine at the time of the first prenatal visit The finding of an Rh-negative mother is the warning sign of impending danger Other than this, there is some confusion as to the remaining obstetrical management As of today, it is recognized that there is no treatment during pregnancy that will improve the baby's chances Attempts at desensitization by haptene injections, ACTH or cortisone have not helped Induction of labor, either at term, at the thirty-seventh week, or in the face of a rising titer, does not appear to be of promise. Cesearan section for delivery is not necessary

Titer determinations, including those for blocking antibodies and anti-Rh antibodies, should be performed early in the pregnancy, and repeated at the seventh month and near term Rising titers are a bad omen When the titer rise is abrupt, or hydramnios develops, x-ray study of the fetus should be made for possible hydrops

At birth, every baby born of an Rh-negative mother should be examined immediately Jaundice, edema and pallor should be looked for A simple blood count should be made Checking the hemoglobin level and erythrocyte count and searching a blood smear for abnormal erythroid elements will give the key to the emergency treatment Exchange transfusion in the birth room is mandatory in the presence of a severe anemia At the time of this birth blood count, the Rh factor should be studied also and the Coombs' test performed A positive reaction to the Coombs' test means trouble This, plus anemia, signifies transfusion, either exchange or small repeated transfusions, depending upon the experience and choice of the obstetrician When the baby's Rh factor is positive and reactions to the other tests are normal, continued observation is in order A negative Rh in the baby gives a feeling of security, yet clinical observation should be continued since laboratory tests are not always infallible

PREOPERATIVE GYNECOLOGICAL MANAGEMENT

The great majority of gynecological procedures are elective This gives the physician ample time to make certain that the patient is in the best possible physical condition

or palpation of the epiglottis *Suction the tracheal fluid until the airway is clear* Gently breathe about 5 cc of air into the catheter (puff it in) at short intervals

4 *Give oxygen,* 6 liters per minute through a mask placed over the baby's face, as soon as respirations begin
5 *Do not give drugs* They do not appear to be of any value and therefore are to be avoided
6 Since an efficient infant respirator or resuscitator has not yet been invented, learn to use the simple measures mentioned

Warmth, opening of air passages, oxygen, gentle handling and patience give the finest results The most important factor, however, lies in the prevention of asphyxia by the practice of good obstetrics

Atelectasis and Hyaline Membrane Formation

These often follow asphyxia They are common in premature infants, but can develop in seemingly healthy full-term babies They are essentially pediatric problems The obstetrician's role is to call the pediatrician whenever there is difficulty at birth, so that he will be on guard and alerted for possible danger

Prematurity

Premature infants require as expert care during labor as following birth The more normal the labor and delivery, the better Analgesics and general anesthetics must be avoided at all costs A wide episiotomy should be made as the presenting part reaches the pelvic floor and before pressure on the perineum has developed Spontaneous delivery should readily follow, but, when it does not, a gentle outlet forceps procedure should be employed This mild operative termination of a premature labor is better than a long second stage However, when possible, any other type of manipulative delivery should be avoided

Cesarean section does not appear to enhance the chances of a premature baby Vaginal delivery seems to be the better When confronted with a complication where a choice as to the type of delivery exists, this point should be remembered

At birth the baby is treated as follows

1 Immediately place the baby in an *incubator* that has been preheated (90° F) and pre-humidified (90 per cent)
2 *Give oxygen,* 1 to 8 liters per minute as needed
3 *Do not handle* Do not be concerned about the weight or cleaning the child Leave it alone completely for about six hours
4 Give vitamin K, 2 mg , intramuscularly, at once

6. *Penicillin*, 100,000 units, in suppository form inserted into the vagina twelve hours prior to surgery is a suggested aid
7. The time-honored custom of giving a vaginal douche has been virtually abandoned
8. Morphine (1/6 grain), or Demerol (100 mg), and atropine (1/150 grain) are given one hour prior to surgery

SPECIAL PREOPERATIVE GYNECOLOGICAL PROCEDURES

Vaginal Reconstructive Surgery

Prior to the repair of prolapse, rectocele, cystocele, enterocele, and urethrocele, the patient should be studied carefully to rule out the possibility of other existing gynecological conditions (ovarian tumors, disease of the cervix) The health of the vaginal membranes should be observed Any existing trichomoniasis or yeast infections should be treated When senile atrophy exists, a week's stimulation with estrogens (to be continued following surgery) will produce better healing

A long-standing eversion of the vaginal mucosa often induces epithelial ulceration Bed rest and keeping the vaginal walls in proper position will heal the involved areas Estrogen therapy is often of help

Fistulae

Urinary fistulae require a careful urological study Cystoscopy and pyelography are necessitated An accurate diagnosis must precede the surgery

Rectovaginal fistulae, likewise, require careful preoperative study Proctoscopic inspection not only aids in noting the exact rectal opening (or openings), but also the inflammatory condition of the surrounding mucosa Bowel sterilization with appropriate antibiotics and chemotherapeutic agents is in order Enemas, repeated until clear, must precede the surgery

Radical Pelvic Surgery

Before proceeding with extensive procedures, such as radical hysterectomy for carcinoma, pelvic exenteration procedures, the removal of large pelvic tumors and vulvectomy for malignant disease, one must double-check the patient's complete physical condition The correction of nutritional imbalance and anemia is a preoperative must, as is making certain that more than enough blood is available for transfusion at the time of surgery

Vaginal smear studies for cancer cells have become a routine part of a gynecological examination It should be made certain that such studies have

From the history, which should be detailed, symptoms may be elicited which suggest closer scrutiny and a more thorough study During the physical examination, associated abnormalities requiring medical or surgical treatment are often discovered Careful palpation of the breasts and digital exploration of the rectum must not be neglected Minimum laboratory procedures include a urinalysis (albumin and sugar) and blood studies (erythrocyte count, leukocyte count, determination of hemoglobin blood level, hematocrit determination and differential cell count)

Each patient must be studied individually Consultation is always in order when medical or surgical problems exist In the presence of a mild hypertension, questionable diabetes, or a severe anemia, the aid of an internist should be secured Securing x-ray films of the chest and a flat plate of the abdomen is a good routine step It might point to the need for further analyses Cystoscopic examination may be indicated in the presence of urinary symptoms Proctoscopic examination may be of value when the symptoms or findings are not directly associated with the apparent gynecological entity One should not hesitate to conduct investigative studies, such as gastrointestinal x-ray examination, intravenous pyelography and, perhaps, psychiatric evaulation

It should be remembered that geriatric patients often have multiple lesions These patients should be studied carefully

Obesity is not uncommon in the gynecological patient This, in itself, is not directly a preoperative hazard However, obese individuals may be hypertensive or have incipient diabetes They may have less cardiac reserve and present a greater problem in anesthesia, fluid replacement and surgical technique than do the normal-weight patients

A final word of precaution should be given It should be remembered that any woman from six to sixty may be pregnant A careful study of the menstrual history, a diligent pelvic examination, a flat plate of the abdomen and biological hormone studies will rule out this possibility When doubt exists and time permits, one should wait for two weeks and then re-examine and re-test Consultation should become routine before any contemplated curettage, hysterectomy, or pelvic laparotomy

Routine orders preceding gynecological surgery include the following

1 *Early hospitalization* (3 00 P M) to enable further diagnostic evaluation, proper laboratory studies and adequate preparation
2 *Early supper* should be light, appetizing, and well served
3 *No oral intake after 9 P M*
4 *Adequate sedation* to insure a good night's sleep
5 *Cleansing enema* (soap suds) at least two hours prior to surgery

maintenance of fluid balance by giving fluids intravenously and/or orally, bladder and bowel care, diet, ambulation, antibiotic therapy and specific therapy

A simple list of orders is given below for the average-sized gynecological patient who has had adnexal surgery or hysterectomy unattended with complications

1 Give Demerol (100 mg) every three hours for relief of pain
2 Give codeine (1 grain) and aspirin (10 grains) every three hours for relief of pain on the day following surgery
3 Give 1000 cc of 5 per cent glucose in saline solution intravenously in A.M and again in P M
4 Give chipped ice after nausea has disappeared
5 Give liquid diet on first postoperative day
6 Catheterize in eight hours or sooner if bladder distention is present
7 Have the patient stand at bedside in A M of first postoperative day

Special Postoperative Orders

VAGINAL PLASTIC PROCEDURES The unique condition present following vaginal plastic procedures is difficulty in urination This is due to the trauma produced by removing the fascia and the vaginal mucosa from the bladder and the urethra Also, following the operations, edema is quite marked, and there may be many small submucosal hemorrhages which will interfere with the normal mechanism of micturition

In general, however, these patients will urinate spontaneously if given the opportunity That is to say, an indwelling catheter, placed immediately following operation, is not necessary If, after the patient has responded from the anesthesia, she fails to urinate within eight to twelve hours, and she has received adequate fluids, a single catheterization may be necessary Following this, if the patient still does not urinate spontaneously, an indwelling catheter may then be placed in the bladder The catheter is left in place for forty-eight to ninety-six hours to allow the edema to recede Upon removal of the catheter, if there is still difficulty in initiating urination, Prostigmin or Urecholine may have to be given The time-honored nursing methods of initiating urination through mental association should never be ignored

Another special consideration following this type of operation is that of ambulation There are many advocates of early ambulation, and, also, of delayed ambulation Because of the site of the repair, it is easy to understand why some surgeons prefer to let these patients stay in bed for seven to eight days postoperatively The added strain of the abdominal viscera

been made prior to the contemplated operation And it is again emphasized that one must be absolutely certain to rule out pregnancy

IMMEDIATE POSTOPERATIVE GYNECOLOGICAL CARE

To be successful, the recovery room must have its personnel trained to anticipate complications in any type of postoperative patient This, of course, includes the gynecological patient, because a vast majority of operations, including those performed in all sizes of hospitals, involves the female pelvis The principal immediate problems are usually those of shock, hemorrhage, obstructed airway and cardiac complications

When a patient arrives in the recovery room, the nurses, interns and residents should be acquainted with the type of operative procedure performed, the patient's condition during the operation, and any preoperative abnormal findings Immediately, the patient is checked for (1) condition of the skin—its color, temperature and texture, (2) pulse rate, (3) blood pressure reading, (4) respiration rate and (5) evidence of vaginal bleeding The pulse and blood pressure should be checked at ten-minute intervals until the patient becomes restless, and this interval should be prolonged if there is any evidence of instability If the pulse is regular and the blood pressure stable, it is possible to prolong the interval between readings to twenty or thirty minutes until the patient becomes conscious Thereafter, readings should be made every hour until the patient is returned to her own room The time to return a patient to her room will, of course, vary, depending upon the extent of the operative procedure In general, a patient who has shown no signs of shock or hemorrhage for six hours may safely be returned to her room at the end of that period

Routine Postoperative Orders

When the patient is removed from the operating room, the surgeon should write very specific orders for the patient and should make note on the order sheet of any anticipated complication It is a healthy habit to have the surgeon write the orders and dictate a description of the operative procedure before leaving the operating suite Also it is good practice to have a short operative note written on a progress sheet before the patient is removed from the operating table These measures will frequently forewarn the personnel of the recovery room of any anticipated complications

In writing postoperative orders, one should have principles in mind, rather than a rigid routine For example, the dosage of a narcotic for a 95-pound patient would differ from that for a 300-pound patient The general principles to be kept in mind are those of analgesia and sedation,

Also, should be mentioned the immediate postoperative care of the vagina following dilation and curettage or biopsy of the cervix Too frequently the surgeon is lured into a false sense of security by placing one or two sponges into the vagina This practice will only delay the manifestations of a severe hemorrhage, but will not prevent its occurrence It is well to leave the vagina free of foreign bodies postoperatively However, if there is continuous brisk oozing from the cervix after a biopsy specimen has been taken, and the wound has been sutured, it may be necessary to place some oxidized cellulose preparation next to the cervix and then pack the vagina tightly This packing should be removed within six to eight hours

Recently, the practice of sending patients home in the evening following dilation and curettage or biopsy of the cervix was initiated No complications have occurred to make this practice inadvisable The patient is instructed to take her temperature twice daily and telephone her physician each evening for two days

Occasionally the curettings will be grossly indicative of carcinoma, and it will not be wise to discharge the patient It is also recognized that occasionally a patient will have to be called back into the hospital for further therapy

The following is an example of the postoperative orders for a patient having dilation and curettage or biopsy of the cervix without complication

1 Give Demerol (50 mg , single dose) if necessary
2 Give liquids as tolerated
3 When the patient has fully responded, she may be permitted to get up, with help, to go to the bathroom
4 Patient to be discharged after being seen by the physician in the evening

Radiation Therapy In the consideration of radium therapy, only intrauterine radiation, for either carcinoma of the corpus or carcinoma of the cervix, will be included

Immediately after the insertion of the radium, regardless of the type of applicator employed, the primary consideration should be *protection* Specifically this means protection to the patient's bladder and the rectum The fornices should be packed tightly with a gauze packing, and the rest of the vagina snugly packed to insure continuous correct placement of the radium and to displace the bladder and rectum as far as possible from the source of the irradiation A retention catheter should then be placed in the bladder and thus subsequently connected for open drainage after the patient has been returned to her room

The postoperative orders for a patient having radium therapy must be written before the physician leaves the operating room This is important

on the pelvic floor, when the patient is in the upright position, and the fact that, in general, these patients are the older ones whose tissues have proved themselves inadequate for support lend rationale to the theory of delayed ambulation On the other hand, since these patients are in the older age group, they are more prone to vascular accidents than are younger patients and need the benefit of muscular activity This activity, of course, can be obtained by having the patient do scheduled exercises while lying in bed

The above discussion is probably irrevelant because the healing of tissue is basically a nutritional problem This means that, if the blood supply to the site of the repair has been interfered with, healing will not take place regardless of the patient's postoperative position Again, because of the unusual age of the patient, any protein deficit must be corrected and anemia must be guarded against If there has been an unusually large blood loss during the operation, blood replacement is mandatory Also, the various products which are known to aid in wound healing should be given

The postoperative orders might be as follows

1 Give Demerol (100 mg) every three hours as required for relief of pain
2 Give codeine (1 grain) and aspirin (10 grains) every three hours as required for relief of pain on the day after surgery
3 Give fluids
4 Give chipped ice, as soon as nausea ceases
5 Give a liquid diet on the first postoperative day
6 Catheterize the patient in eight hours or sooner if distention is present, if the patient is unable to void after another eight hours, insert a Foley catheter and institute open drainage
7 Encourage spontaneous activity in bed, if the patient does not move her legs sufficiently, give passive lower extremity exercise
8 Obtain a complete blood count and hematocrit determination on A M of first postoperative day
9 Give vitamin C (500 mg) daily
10 Give multiple vitamin B daily

DILATION AND CURETTAGE, AND BIOPSY OF THE CERVIX The description of an adequate dilation and curettage or biopsy of the cervix is not within the scope of this book However, it is the duty of the surgeon and part of the postoperative procedure to make certain that all specimens are adequately marked, separated and delivered to the pathologist This includes, in all dilation and curettage procedures performed for diagnosis, placing in separate bottles and labeling the scrapings from the endocervix, those from the endometrial cavity and the sections of the cervix

Also, should be mentioned the immediate postoperative care of the vagina following dilation and curettage or biopsy of the cervix Too frequently the surgeon is lured into a false sense of security by placing one or two sponges into the vagina This practice will only delay the manifestations of a severe hemorrhage, but will not prevent its occurrence It is well to leave the vagina free of foreign bodies postoperatively However, if there is continuous brisk oozing from the cervix after a biopsy specimen has been taken, and the wound has been sutured, it may be necessary to place some oxidized cellulose preparation next to the cervix and then pack the vagina tightly This packing should be removed within six to eight hours

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The postoperative orders for a patient having radium therapy must be written before the physician leaves the operating room This is important

primarily because the exact time of radium insertion is recorded and a definite time must be indicated on the order sheet for the radium to be removed

While the radium is in place, the patient may be apprehensive and restless with the attending danger of *dislodging the radium* Therefore, it is necessary to keep the patient quiet and provide adequate sedation to accomplish the treatment safely

Also, while the radium is in place, the diet should consist of only liquids, to make certain that the patient will not have a bowel movement and, in the process of straining, will not push out the packing

Finally, the patient may become disoriented because of the sedation, anesthesia, age, or a combination of factors, and remove her own packing and attempt to remove the radium In the experience of the author and his colleagues, on two known occasions, the radium has been removed by the patient and deposited in and flushed down the toilet Such a mishap is expensive

REPAIR OF FISTULA If the preoperative management has been good and the operative procedures have been accomplished with special reference to anatomical closure and adequate blood supply, the postoperative care is relatively easy, but extremely important Basically it involves nutrition, rest and sterility

The nutrition principle includes, of course, obtaining the best preoperative nutritional status possible for the patient It also includes the vascular supply to the incision Special attention must be paid to the protein status and the replacement of any moderate blood loss during the operation Also the maintenance of good fluid balance and administration of vitamins, including vitamin C, are vital factors

The rest principle applies to the tissues involved For example, no undue stress must be placed upon the bladder or rectum, as the case may be Therefore, in the recovery period, it is best to have a catheter in the bladder with open drainage, and, because the sutures will be the weakest on about the sixth day, the catheter should be left in place for ten days Also, in this type of repair, it would be best to rely on late ambulation

Following repair of a rectovaginal fistula, the bowel should be kept at rest for a minimum of eight days This regimen should be carried out even when the rectovaginal fistula is a small one, because, if the first procedure is not successful, each subsequent attempt at closure becomes most tedious and difficult

The sterility principle implies that every attempt must be made to prevent infection of the wound Therefore, in patients having a rectovaginal fistula, special attention must be paid to the bowel, both pre- and post-

operatively A nonabsorbable type of sulfa drug, such as Sulfathalidine, is best. If there is any evidence of an infection postoperatively, antibiotic therapy is instituted In general, the antibiotics should not be used preoperatively because of the chance of yeast infection in the vagina which would interfere with adequate wound healing The use of Sulfathalidine should be continued for approximately two weeks following the operation

In a patient with a vesicovaginal fistula, any chronic cystitis must be treated vigorously preoperatively Postoperatively, special attention to the catheter must be given by a nurse, intern or resident who is fully cognizant of its vital role in the success of the operation The bedside bottle connected to the catheter must be checked frequently each day to see that the catheter or tubing is not obstructed, thereby allowing the bladder to become distended The catheter should be irrigated twice daily with a mild antiseptic solution Upon removal of the catheter after ten days, repeated catheterization may be necessary to prevent the bladder from becoming distended Catheterization for residual urine should be carried out until the residue is no more than 50 cc on at least two occasions

VULVECTOMY Following a vulvectomy, the basic considerations for any major operative procedure must be followed, and it should be pointed out that frequently the blood loss during the operation is deceiving These patients may lose from 1000 to 1500 cc of blood, and this loss should be anticipated before surgery

Generally, the skin is closed with a nonabsorbable suture, preferably of silkworm gut or wire This poses the important postoperative care of the toilet Following each bowel movement, the perineum must be carefully cleansed and an external douche given It is even a good idea to sterilize the bowel pre- and postoperatively for this type of procedure

POSTOPERATIVE GYNECOLOGICAL COMPLICATIONS

Shock

Gynecological surgery has no immunity against this dread complication Treatment should be instituted early and vigorously

Hemorrhage

VAGINAL BLEEDING A bloody discharge, sufficient to saturate one pad in about three hours, is expected following most vaginal surgery, or when a total hysterectomy has been performed More than this amount is a warning A continuous flow, or the passage of clots, demands action

1 Return the patient to the operating room
2 Give 1000 cc of 5 per cent glucose in saline solution intravenously to keep a vein open

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vessel is ligated and the abdomen closed Active therapy and blood replacement are continued

At the time of the original operation the ovarian vessels should, in most instances, be doubly ligated to prevent retraction of these vessels into the infundibulopelvic ligament, which may produce a massive retroperitoneal hematoma This complication as well as bleeding into the abdominal cavity can be avoided to a great extent by not including too much tissue in any one ligature, transfixing the suture and by not clamping across a previously placed suture

The uterine vessels are the major ones involved in pelvic surgery and, more specifically, in a hysterectomy Care should be taken to identify these vessels during surgery Here, especially, one should beware of clamping across the suture which contains the uterine artery Several times it has been noted that the operator, in trying to stay close to the uterus, will place a suture on the uterine artery in such a position that it is impossible to clamp the lower portion of the cardinal ligament without crushing the previous suture Then, shortly after closing the abdomen, the suture will break and the patient go into sudden and very profound shock

Bleeding from the Wound Area Immediately following abdominal surgery, bloody dressings may be noticed When this occurs the dressings should be changed and a pressure bandage applied If this does not stop the bleeding, the patient is returned to the operating room where the bleeding area is resutured

A serosanguineous discharge or any bloody discharge occurring after the day of operation is a warning of a wound separation One must not wait until the entire wound snaps open and the bowel is extruded The patient should be returned to the operating room at once, the wound opened and re-suturing in detail performed

Hematomas In the pelvic and retroperitoneal area, hematomas may develop both rapidly and slowly Bleeding into the broad ligament and other retroperitoneal spaces usually comes from a venous plexus and is a slow continuous oozing Shock is not usually present, although the patient will invariably exhibit signs of weakness, tachycardia and repeated episodes of a mild shocklike state A progressive anemia may also take place In time, a large pelvic-abdominal mass will be felt

Occasionally, the hematoma stops growing and blood replacement corrects the anemia, gradual absorption is then the rule Often a sudden gush of old blood will come from the vagina as the hematoma empties itself Should progression of the blood mass take place, along with persistent anemia and a semi-shock state, the patient should be returned to the operating room where the hematoma is evacuated and the bleeding vessel ligated

3 Have enough blood ready
4 Find the source of the bleeding

Postoperative vaginal bleeding often takes place from a perineorrhaphy wound, especially at the upper angle of the vaginal wound Ligation of the bleeding vessel is necessary When a large hematoma is forming, the perineum should be widely opened and the area resutured

Bleeding may take place from the lateral vaginal wall due to overly strong retraction made during surgery A mattress suture will usually readily control the process

Bleeding from the anterior vaginal wall is not common, but may take place

Vaginal cuff bleeding of any extent means that the origin is somewhat higher up It may be prevented by placing a suture to involve the lateral angles of the vaginal vault When such bleeding occurs the cuff is opened and the lateral areas are inspected for bleeding from the branches of the uterine vessels

INTRA-ABDOMINAL HEMORRHAGE Certainly, this is the most serious of all postoperative complications It demands early diagnosis, the immediate treatment of shock, urgent laparotomy, and sufficient blood replacement

This diagnosis must be considered whenever shock develops following surgery At the first signs of shock, evidence of it should be sought The tone of the abdominal wall is noted and observation is made as to softness, amount of tenderness, and distention A pelvic examination is carefully executed to ascertain any feeling of bulging or fluid in the cul-de-sac The possibility of vaginal bleeding is ruled out A blood count is made, but it should be borne in mind that the clinical signs of intra-abdominal hemorrhage far outweight the laboratory findings As the state of shock lessens, the physician must be on guard If abdominal tenderness or distention increases, or pelvic examination reveals fullness in the cul-de-sac, the patient should be taken to the operating room at once If signs of shock should again develop, this is almost a pathognomonic sign of concealed hemorrhage and demands immediate laparotomy

Of course, treatment should be instituted to combat the shock and blood loss should be replaced After shock has been reduced as much as possible and plenty of blood is ready for transfusion, operation is started The abdominal wall is opened rapidly, yet gently The source of bleeding is looked for at four spots from the ovarian vessels and the uterine vessels Rarely the bleeding will come from an exposed vessel in the omentum, bladder area, or from the venous organs of raw surfaces The bleeding

blood supply and tissue necrosis, it may take place early or late in the postoperative period The drainage may be into the space of Retzius, intraperitoneally or into the broad ligament The patient will immediately become severely toxic, having fever, rapid pulse rate, pain, and, often, mental changes Extensive tenderness in the area involved and hematuria will be present Re-operation must be done immediately

Wound Complications

Wound complications, such as separations, dehiscense, hematoma formation and infection, are, unfortunately, not at all uncommon

SPECIAL GYNECOLOGICAL PROBLEMS NEEDING INTENSIVE THERAPY

Severe Vaginal Bleeding

Vaginal bleeding of a gynecological nature rarely is so severe as to necessitate immediate intensive therapy Bleeding, as such, usually sufficiently warns the patient of impending trouble early enough to cause her to seek medical care before an emergency arises

Sudden profuse bleeding, regardless of the history, should warn one of the probabilities of an impending abortion or the effect of criminal tampering Examinations should be conducted with this in mind and appropriate therapy instituted

Functional Uterine Bleeding

Functional uterine bleeding, i e , a profuse, irregular vaginal bleeding in the presence of normal palpable and visible pelvic structures, may recur often enough to require emergency care The patients are usually adolescents or young adults First of all, blood studies should be made to rule out the possibility of a blood dyscrasia as the cause of the bleeding Next, a careful pelvic examination should be made to determine the source of the bleeding (in functional uterine bleeding it will be from the uterus) Shock is treated and lost blood is replaced The bleeding is stopped, at least temporarily, by performing a thorough curettement Appropriate glandular therapy is instituted later

In all such patients, the principles of stopping the blood flow, treating shock, replacing blood, and, most important of all, making an accurate diagnosis must be remembered

Fibroids and Polyps

Submucous fibroids (pedunculated) and large polyps (endometrial or cervical) may cause a sudden bleeding episode The dilated, effaced cervix

Pulmonary Complications

The gynecological patients will not be unique in developing the various pulmonary complications Paramount, of course, during the immediate recovery period is maintenance of an open airway

Cardiac Complications

Threat of these complications is ever present and, with the increase in life expectancy, it is only proper to anticipate that more elderly gynecological patients will reach the operating room Elective surgery in these patients will require more complete work-up preoperatively than in younger subjects, in order that undue operative risks will be avoided

Urinary Complications

Urinary complications are common to the surgical gynecological patient

When it is known that the bladder has been cut or torn or the ureter has been opened during operation, repair is, of course, made at once However, when such damage has been done and is not recognized, tragedy ensues

Urinary retention following gynecological operations is treated in the same manner as when it occurs following delivery Ambulation, catheterization and time will usually effect a cure

Anuria demands immediate lifesaving measures Should the patient not void in eight hours following surgery and catheterization shows that the bladder is empty, cystoscopic examination is performed immediately and both ureters are catheterized If ureteral obstruction is present bilaterally, operation to free the obstruction and repair the ureters is performed at once

Oliguria may be due to dehydration, shock, or ureteral bleeding When none of these factors is present, cystoscopy and ureteral catheterization are performed When indicated, surgical treatment is instituted

Hematuria is indicative of urinary tract damage In the absence of other symptoms, a retention catheter is inserted to be left in place for several days (seven to ten) to allow for spontaneous healing

Leakage of urine vaginally means that a fistula is present The fistula may be from the ureter or from the bladder If it is from the bladder, a retention catheter is employed If the fistula persists, repair is made at a later date

Urinary extravasation may occur due to bladder or ureteral damage Since this may not be due to trauma itself, but to interference with the

will be diagnostic Packing is rarely of value Cauterization of the growth will give temporary relief from the bleeding Occasionally, ligation of major vessels is to be considered in an effort to prolong life

Endometrial carcinoma in its late stages may produce severe bleeding Examination will show that the bleeding comes from the uterine canal A curettement will temporarily help, while one contemplates future surgical or radiological care

Carcinoma of the corpus in its early stage causes a small amount of irregular vaginal bleeding Findings on examination are usually negative Smears will be of help only when positive Diagnostic curettage should be employed One should beware of the patient with negative findings who continues to bleed

Ovarian cancer is insidious and deadly Any constant ovarian lesion should be explored and examined microscopically

Cancer of the vulva starts with a lump or a sore Biopsy is always indicated Patients with an atrophic vulvitis should be watched carefully, especially if leukoplakia areas are present Frequent biopsy is indicated

Advanced cancer calls for careful management Certainly, pain relief by means of drugs or nerve paralysis is of extreme importance Consultation should be sought and the possibility of further radical surgery or employment of the newer radioactive experimental procedures considered Excessive bleeding may be controlled by ligation of the major vessels Everything in the physician's power should be done to arrest the disease and give comfort to the patient

Radiation therapy, either with radium or the newer radioactive metals, demands treatment at a radiation center, having a radiologist, a physicist and an expert in the atomic energy field in attendance Although progress has been rapid in this field, it is still in an experimental stage This treatment for cancer should not be attempted by the gynecologist, even though he can place radium in the vagina, cervix or uterus as was done in the 1930's, today an expert is required Expert advice and help must be sought

THE ACUTE ABDOMEN IN RELATION TO OBSTETRICS AND GYNECOLOGY

Intensive diagnosis is certainly a necessity in all patients having acute abdominal pain A careful pelvic examination must be made in every instance

In any acutely ill woman, the possibility of ruptured ectopic pregnancy, twisted ovarian tumor, acute appendicitis and complications of pregnancy (criminal abortion with possible uterine perforation) must be kept in mind

with a protruding mass will be diagnostic Removal after carefully ligating the pedicle is in order

Trauma

Post-marriage trauma to the genitalia, such as lacerations of the hymen or vagina, is not uncommon A careful history plus a search for the source of the bleeding will usually yield results Suturing of lacerations to control bleeding, treatment of any existing shock, and blood replacement are in order

Falls, explosions, forceful sexual attacks, and automobile accidents may cause external genital injury and hematoma formation

Injury to the area about the clitoris, urethra, hymen and perineum will lead to severe bleeding Thorough inspection should always be made for the source of bleeding Appropriate ligatures should be placed to control the bleeding Treatment should be given for shock and lost blood should be replaced

Following severe accidents (auto, explosions, falls) the pelvic area should be examined Visible bleeding and hematoma formation will be readily noted The possibility of internal bleeding should not be overlooked, pelvic cellular hematomas should be especially sought when the pelvis has been fractured

Rape is serious from the physical, mental and legal aspects In all such cases, the physician should remember that he is the doctor, not a judge or attorney Lacerated areas should be sought and treated as indicated Then vaginal smears should be obtained and search made for spermatozoa All vulval, urethral and cervicovaginal discharge should be collected for spermatozoa studies Accurate records of the findings should be kept

Carcinoma

Carcinoma of the female pelvic structures is so amenable to early diagnosis and therapy that both the patient and the physician must be encouraged to keep this possibility always in mind, regardless of the symptoms

Carcinoma of the cervix, of the group 1 type, is usually without symptoms Diagnosis is made through a study of vaginal smears and a careful inspection of the cervix (with biopsy of suspicious areas) in every woman Any irregular type of bleeding or bloody discharge should be regarded with suspicion and thorough studies made

Carcinoma of the cervix, can, of course, lead to a "bled-out" patient However, the history will invariably tell of continued bleeding episodes, and the ulcerated cartilaginous cervix or the large cauliflower-like growth

Chapter 18

VASCULAR SURGERY

WILLIAM S DYE, JR, M D, and ORMAND C JULIAN, M D

THE FUNDAMENTAL CARE of a patient undergoing cardiovascular surgery is essentially the same as that of a patient having any other type of major surgery Attention to adequate airway, prevention of chest complications, management of intestinal ileus, accurate knowledge of intake and output, and accurate fluid balance maintenance are all common problems of any postoperative surgical patient The extension of surgery to include the heart and large vessels introduces other problems common to this type of surgery The discussion of the management of the cardiovascular surgical patient may be divided into three headings, namely, intrathoracic, including cardiac and great vessel surgery, vascular surgery in the abdomen, and peripheral vascular surgery

INTRATHORACIC SURGERY

Certain types of cardiac lesions commonly subjected to surgical treatment predispose to pulmonary complications The patient who has repeatedly been in cardiac decompensation, and in whom, in spite of medical therapy, compensation may be inadequate at the time of surgery, is an example Such a state is frequently encountered in individuals having long-standing mitral disease with right-sided heart failure There is not only the factor of myocardial disease but also that of pulmonary congestion and pulmonary artery and arteriolar changes due to the duration of the disease Such patients are particularly prone to postoperative atelectasis and pulmonary infarcts, either due to emboli or thromboses of the vessels in the lung The very vascular lung associated with left-to-right shunt, as in patent ductus, large interauricular septal defects, or aortopulmonary septal defects, is particularly prone to complications following surgery, particularly in adults

The possibility of these surgical emergencies must be ruled out before adopting conservative or medical therapy

Often one cannot make an accurate diagnosis in patients with acute abdominal symptoms The important point is to differentiate between a "surgical abdomen" and a nonsurgical one Pain is, of course, a serious symptom and is as important as increasing pulse rate or beginning shock Next, progressive tenderness and rigidity and the findings of a tender pelvic mass will encourage exploration The blood count must be watched and urinalysis of a catheterized specimen should be made Conservatism should be practiced in the presence of high fever, excessive leukocytosis, eosinophilia, red cells and pus in the urine, severe pain associated with a paucity of definite findings, and a listing of long-standing medical care

Time and repeated examinations will usually point to the probable diagnosis When doubt exists and the symptoms point to impending shock exploration should be made

In all cardiac patients, oxygen administration is continued in the recovery room either by means of a tent or nasal catheter The tent is valuable in extremely hot weather when air-conditioning is not present The nasal catheter provides a more effective means of administering oxygen The placement of this catheter should be supervised and checked by the physician in charge If it is placed too far back, extending into the nasopharynx, gastric dilatation will result and may even lead to death by gastric rupture or by reducing respiratory excursions

The head rest is usually elevated approximately 20 degrees for the cardiac patient if his blood pressure is stable Aspiration of secretions from the tracheobronchial tree, usually done by the anesthetist at completion of surgery, may have to be repeated following return to the recovery ward If the endotracheal tube is in place, the procedure is greatly facilitated If the patient is practically or completely awake, the passage of the catheter through the nasal passage and into the pharynx in itself may stimulate coughing to eradicate any mucous obstruction Blind passage of the catheter into the trachea is successful in most cases We have not made routine use of postoperative bronchoscopy in cardiac surgery There will be occasions, however, when it is lifesaving On occasions, particularly if the patient has had a cerebrovascular accident, tracheostomy may be a lifesaving measure and we have not hesitated to carry out this procedure when it is indicated The patients requiring it are usually those who cannot cough and in whom repeated bronchoscopy is not practical

The patient, on his arrival in the recovery room, must have a complete check of certain vital functions The presence of the peripheral pulses should be determined because of the hazard of peripheral emboli, particularly in patients subjected to mitral valve surgery Check of the carotid pulsations is included, because occasionally a cerebral vascular accident occurring during surgery may result in an embolus in the common carotid artery bifurcation on one side Observations of the size of the pupils, reactions of the patient and state of muscle tonus may give a clue, in a patient who is not awake, as to possible cerebral vascular catastrophe

Venous distention in the neck during the immediate postoperative period as the patient is regaining consciousness usually is simply the result of straining The presence of the endotracheal tube in a patient who is coming out of anesthesia may be enough stimulus to cause the patient to strain, resulting in venous distention, the simple removal of the tube will correct this situation Chest pain and discomfort will also produce straining More serious implications of venous distention are cardiac failure, inflow obstruction to the right side of the heart, herniation of the heart through the pericardial incision and pressure pneumothorax with massive collapse Immediate examination of both lung fields with the aid of a steth-

The proper management during surgery plays a major role in preventing postoperative lung complications The elements of this management consists in attention to adequate ventilation of the side not operated upon and frequent expansion of the lung on the operative side during surgery During closure of the thoracotomy wound, care is taken to obtain complete inflation of the lung Intercostal nerve blocks accurately placed from within will help in the postoperative management by preventing extreme postoperative pain Aspiration of the blood from the thoracic cavity prior to closure is important to allow complete expansion of the lung and to reduce the reaction of the pleura Closure of the chest with water seal drainage, of course, is the standard procedure and the use of large tubes, such as no 36 F, assures adequate maintenance of communication The use of small dressings allows for accurate examination of the chest postoperatively and also avoids the constriction of the chest by large adhesive bandages

When the chest has been closed, management starts with the assurance by the anesthetist that the lung has been completely expanded, as evidenced by the cessation of air escaping through the tube in the water seal bottle and negative pressure The patient in the lateral position is usually left in this position and at the time of moving is placed immediately on the stretcher or recovery ward type of bed The ideal arrangement is to have a cloth container under the stretcher or bed, some distance below the level of the patient, to accommodate the water seal drainage, which may be left open during the transportation at all times An alternate method is to clamp the water seal tube, using two hemostats for security, and place the water seal bottle on the stretcher between the legs of the patient One person must be responsible to see that the tube is not pulled out of the chest at the time of moving the patient from the table to the stretcher or during transportation to the recovery ward The endotracheal tube may be left in place while the patient is moved, depending upon the patient's state of consciousness Usually it is left in place for adequate airway and for administration of oxygen during the period of transportation The gentle handling of the patient at all times is an obvious caution not always strictly adhered to

On arrival in the recovery room the same attention to the chest tube and gentle handling are needed Ideally, special recovery room mobile beds may be used to transport the patient, obviating the need to transfer the patient a second time The underwater seal is immediately taped to the floor by large strips of 3-inch adhesive to avoid the unfortunate accident of somebody knocking it over and permitting inflow of air Special attention is given to allowing enough length to the tube so that the patient may move from side to side, and to ascertaining that there are no kinks in the tube and that the water seal is functioning properly, as evidenced by negative pressure effect on the column of water

The complications usually met with in postoperative chest patients undergoing cardiac or large vessel surgery are those associated primarily with the airway, those associated with bleeding from either the surgical area such as the heart, or from the chest wall itself, or from anastomotic sites of blood vessel grafts in large vessels, and, thirdly, the presence of air in the chest cavity

Respiratory difficulty is a signal for immediate action Its most common cause postoperatively is an obstructed airway, which may occur in the immediate postoperative period and result from removing the endotracheal tube too soon, improper placement of the regular airway, and, of course, one of the most common causes, a mucous plug in one of the bronchi with resulting obstruction Observation of the expansion or retraction of the chest wall together with stethoscopic examination of the chest usually makes the diagnosis quite clear

Bleeding following surgical procedures in the chest is either immediate or delayed Bleeding occurring in the immediate postoperative period may be manifested only by a drop in blood pressure, elevated pulse rate and subsequent confirmation of blood loss by blood counts and hematocrit readings, although these can be misleading, particularly in a patient with hemoconcentration Blood volume studies are extremely helpful here The appearance of large amounts of bloody drainage in the water seal bottle will also give a clue to bleeding into the chest cavity, either from large vessels or intercostal arteries In intracardiac surgery, bleeding into the pericardial sac may be manifested if the pericardium has been closed too completely or adequate drainage is not provided A compression cardiac syndrome appears, including distended neck veins and progressive cardiac failure Either distention of the veins of the neck or progressive cardiac failure constitutes an emergency and the patient must be returned to the operating room for re-exploration A moderate amount of drainage in the water seal tube is frequently noted and one may see up to 1000 cc of drainage Determinations of hemoglobin content of this drainage will give a clue as to whether the fluid represents a serous reaction to blood in the pleural cavity or whether it is due to a real hemorrhage

Delayed bleeding may occur following either cardiac or large vessel surgery in the chest, but is usually associated with large vessel surgery It may occur following difficult bowel evacuation of some extremely hard feces some days after surgery Difficult bowel movements should, of course, be avoided at all costs, mineral oil should be administered and low oil enemas given in anticipation of this possibility In patients, for instance, with a large vessel graft, a small leak may start with sudden exertion or straining and the only symptom the patient may exhibit is apprehension,

oscope will determine quite accurately in most cases the degree of expansion of the lung

It is important that a patient recovering from major cardiac or large vessel surgery in the chest be given extremely small doses of analgesics to minimize any depressive effect on the patient Analgesics, such as Demerol, are withheld until the patient is completely awake and actually requires such a drug for relief of pain, not restlessness Even at this time, small doses are used, e g , 25 mg of Demerol In the period of stabilization of the patient following surgery, which extends usually over the first twelve to twenty-four hours, frequent blood pressure readings are necessary The peripheral pulses are repeatedly examined during the day, and the state of reactivity of the patient is judged by response to questioning Checks on the closed chest drainage to insure patency of the drainage tube are extremely important

The patient plays an important part in his recovery Preparation starts prior to surgery, at which time the patient is told of the importance of coughing and deep breathing following his surgery If this is emphasized to the patient prior to his operation, the cooperation and actual participation of the patient in his responsibility are good All patients are hesitant to cough following surgery Thus previous indoctrination is helpful The patient is encouraged to move about, turn from side to side with help and move his legs and toes frequently The instruction to the patient that these activities are his part in recovery, and the most important part, will help in making the theory that the patient's role is of primary importance a reality

The postoperative orders must be specific and detailed Nurses respond much better to specific instructions rather than generalized ones The orders for fluid administration in patients undergoing cardiac surgery must be meticulous, since the amount of fluids tolerated by the cardiac patient is reduced The orders must be very specific as to the rate of administration and the amount of fluid given during surgery must be taken into consideration The orders for fluid administration should cover only short periods, and should be revised each four hours during the first twenty-four to forty-eight hours Most of the patients do not even need intravenous fluids by the second postoperative day and are encouraged to start oral intake as soon as possible The writing of the order to encourage deep breathing is often only a gesture The nurse in charge should be appraised of the importance of this measure and instructed in the exact meaning of the words Any cessation of the fluctuations of the water seal should be noted immediately The exact amount of elevation of the head of the bed should be recorded on the orders in degrees or inches that the head is to be placed above the horizontal plane

3 Prepare anterior chest, including the axilla on the left side
4 Give nothing by mouth after midnight
5 Give tap-water enema the night before operation
6 Give Demerol, 50 mg., and atropine, 0.4 mg., one hour before operation
7 Have oxygen available in the room
8 Give Combiotic, 0.5 gm., intramuscularly, the night before surgery
9 Give fortified Crysticillin, 400,000 units, intramuscularly, the morning of surgery

IMMEDIATE POSTOPERATIVE ORDERS (MITRAL COMMISSUROTOMY)

1 Check blood pressure and pulse and respiration rates every fifteen minutes until they are stable, then every hour for eight hours, then twice a day
2 Turn the patient and have him cough and breathe deeply every hour for the first twenty-four hours
3 Give carbon dioxide every hour for twenty-four hours (nurse to be instructed to avoid overzealous administration)
4 Check facial expression, state of consciousness and movements of all extremities every half-hour until the patient is awake, and then every hour for twelve hours
5 Elevate the head of the bed 20 degrees after the patient is awake and blood pressure has become stable
6 Give fortified Crysticillin, 400,000 units, intramuscularly, at 9:00 A.M. daily for five days
7 Give Combiotic, 0.5 gm., intramuscularly at 9:00 P.M. daily for five days
8 Water seal bottle to be taped to floor and changed by intern or resident if bottle becomes two-thirds full
9 Have x-ray film of chest made with aid of portable apparatus the morning after operation
10 Give fluids intravenously, usually a total of 2000 cc. of glucose and water, including that given during operation, for the first twenty-four hours
11 Give fluids by mouth and a soft diet as soon as tolerated
12 Give Demerol, 25 mg., every three hours as necessary until the patient is completely active and requiring more sedation, which is usually on the day following operation
13 Have a complete blood count and hematocrit reading made following operation and repeated the following morning

if the leak is not too large at this time there may be no change in the blood count or blood pressure With the gradual accumulation of blood there may be some slight sign of jaundice and x-ray evidence of fluid in the chest If the hemorrhage ceases spontaneously, then the main problem is a large amount of clotted blood present in the thoracic cavity Strict attention to the possibility of early decortication is then important

Pneumothorax following chest surgery in which the lung proper has not been involved is usually due to inadvertent injury of the lung and failure to recognize the leak during surgery, or to injury of the lung by a sharp-pointed rib approximator as the lung is expanded by the anesthetist during closure of the chest cavity With the functioning water seal, the leak is readily recognized by the continued escape of air through the water seal tube In most instances, if the leak is small, it will become sealed off in twenty-four to forty-eight hours and no further treatment is necessary It is important, of course, to leave the water seal tube in until all signs of leak have disappeared If, for some reason, the water seal tube does not function, then, of course, pneumothorax may be an extreme emergency, manifested by respiratory difficulty and usually easily recognized on physical examination Routine postoperative chest films should be secured, however, and may reveal an undiscovered partial pneumothorax Leak around the chest tube itself does occur if the hole is made too large, but it is not the usual cause of a pneumothorax The presence of superficial blebs in the lungs at the time of surgery, of course, constitutes a distinct warning to watch for possible spontaneous pneumothorax following surgery If the pneumothorax persists and the leakage through the water seal persists in spite of everything, then reoperation may be necessary to close the hole At times, leaving the water seal in actually encourages the holding open of this hole, and removal of the water seal and management of the residual air by aspiration comprise all the treatment that is necessary

Below are given the detailed preoperative and postoperative orders for a patient having a mitral commissurotomy Hard and fast rules are not always advisable in the management of any patient However, certain specific details are necessary to assure proper care Immediate postoperative management is concerned, of course, with analgesia requirements, blood requirements, and careful attention to respiratory exchange and functioning of the water seal bottle, observation for cardiac arrhythmias, and, finally, the general care that applies to most surgical patients

PREOPERATIVE ORDERS (MITRAL COMMISSUROTOMY)

1 Seconal, $1\frac{1}{2}$ grains at bed time
2 Type and crossmatch blood

operative fluid orders are extremely important insofar as supplying the maximum calories possible Fructose or 10 per cent glucose is used in an effort to swell the total caloric intake It is best to employ only the very minimum blood transfusions to avoid hazard to the patient, since the cirrhotic patient tolerates transfusions poorly It is also thought important to administer oxygen postoperatively to give the liver every possible chance Vitamin K is not administered routinely postoperatively, since most of these patients have had the maximum vitamin K therapy prior to operation We have not used anticoagulants following portacaval shunts

Resection of the abdominal aorta and its bifurcation for aneurysm or arteriosclerotic obstruction has become a fairly well-standardized procedure The cardiac and renal status are extremely important in these patients since they most always have fairly generalized arteriosclerosis, the young individual with a Leriche syndrome being an exception Careful studies of renal function and cardiac evaluation are made prior to operation These are of particular importance when it may be necessary to occlude the blood supply to the kidney for a period The bleeding abdominal aneurysm, of course, constitutes an emergency and preoperative work-up is not possible

Preoperative and postoperative orders for patients having resection of the bifurcation of the aorta and replacement by homologous graft or prosthesis are outlined in detail below

PREOPERATIVE ORDERS (RESECTION OF BIFURCATION OF AORTA WITH REPLACEMENT)

1 Sedation at bedtime the night before surgery
2 The entire abdomen, upper thighs and chest are prepared, since at times it is necessary to extend the incision into the chest, and also it is necessary to expose the femoral vessels on occasions
3 A Foley catheter is inserted after the patient is brought to the operating room
4 Six units of blood are made available for transfusion in the operating room
5 Give a tap-water enema the night before operation
6 Give nothing by mouth after midnight
7 Have oxygen tent and two intravenous stands available in the recovery room
8 Have a Wangensteen suction apparatus set up in the recovery room
9 Give Demerol, 50 mg, and atropine, 0 4 mg, one hour before operation

14 Use oxygen tent or nasal oxygen as required
15 Record intake and output
16 Administer digitalis as previously given to the patient, however, the patient's requirements may change considerably following operation and a patient who has never been on digitalis therapy may require it It is not uncommon for a patient who has previously had a regular rhythm to develop fibrillation on the fourth or fifth day, requiring complete digitalization

POSTOPERATIVE CARE WHEN HYPOTHERMIA HAS BEEN EMPLOYED

If hypothermia has been used, as in resection of aneurysms of the thoracic aorta, hot water bottles are made available in the room and placed around the trunk and the extremities of the patient Warming is actually started in the operating room by reversing the hypothermia blanket near the end of the procedure A chart is kept of the patient's temperature and accurate recording is made of the hour-to-hour temperature following operation Of particular importance in these patients is the placement of a Foley catheter and accurate hourly recording of the urinary output

VASCULAR ABDOMINAL SURGERY

The two major abdominal procedures in vascular surgery are portacaval shunt and resection of lesions of the abdominal aorta, either for aneurysm or arteriosclerotic obstruction Preoperative and postoperative care follow the same principles as those operative for any abdominal surgery with a number of additional points

With both venous shunt procedures used in the treatment of portal hypertension a combined thoracoabdominal incision is used, and therefore the postoperative care of the chest is the same as is employed following any other chest exploration The special points in the preoperative and postoperative care are related to the possibility that esophageal varices may be present and may bleed during the operation, to the liver function and to the coagulation mechanism The patients should have a heparin-protamine titration before operation, because an occasional patient will show increased heparin activity, and the rare one may require protamine administration during surgery Owing to the poor prothrombin activity of these patients, it is advisable to have several pints of freshly drawn blood available, if possible A gastric aspiration tube is not used routinely because of the presence of the esophageal varices, however, if gastric dilatation or ileus persists after surgery, such a tube must be employed regardless of the hazard Because the patient usually has primary liver disease, the post-

operating room Owing to the prolonged traction and the necessity of placing the intestine outside the abdomen during the operation, these patients often have quite an extended paralytic ileus requiring gastric aspiration for as long as four to five days The tube is not removed until the patient has good bowel sounds and is passing gas per rectum, before it is removed it is clamped off for a test period to make certain that its use is no longer necessary Postoperative anticoagulants are not used in any of our patients having vessel grafts, no matter where these grafts are located Fluid management may be very markedly altered in patients in whom it has been necessary to place a clamp above the renal arteries during the operation, occluding the blood supply of the kidneys for a significant period These patients universally have a period of oliguria postoperatively While oliguria exists, fluid administration is reduced to the minimum requirements, this may be no more than 1200 to 1500 cc per day, the amount representing the total amount of urine excreted plus the fluid lost by gastric aspiration and the insensible loss This regimen has been very successful in managing these patients and, in spite of a prolonged oliguria, in some of them who have had the artery clamped above the renals, the outcome has been good Patients who have had the renal artery occluded for long periods have all been under hypothermia at the time

The careful watching of the status of the pulsations distal to the graft is extremely important, since, on rare occasions, the graft or distal arteries may thrombose Patients with extremely severe arteriosclerosis obliterans, prior to resection, for example, of aneurysms, are those in whom thrombosis of the distal arterial tree may occur During operation, heparin is run into the distal arteries all the time that the blood is being excluded from the lower extremities The maintenance of blood pressure following operation is extremely important to prevent any periods of hypotension and possible subsequent thrombosis

PERIPHERAL VASCULAR SURGERY

Arterial Embolectomy

This is one procedure in arterial surgery in which anticoagulants are always used preoperatively and, in addition, heparin also is used postoperatively The essential problems connected with removal of an arterial embolus are the prevention of further thrombosis following the procedure and the relief of spasm The position of the extremity is usually level with the body There is some evidence to support the fact that actual lowering of the extremity 8 to 10 degrees constitutes the optimum level For relief of spasm following arterial embolectomy, several measures are available

10 Have large jug and tubing available in the recovery room for connection postoperatively to Foley catheter
11 Have hot water bottles available in the recovery room if hypothermia has been used

POSTOPERATIVE ORDERS (RESECTION OF BIFURCATION OF AORTA WITH REPLACEMENT)

1 Check blood pressure and pulse and respiration rates every fifteen minutes until they are stable and then every hour for ten hours, and then twice a day
2 Turn the patient and have him cough and breathe deeply every hour
3 Give whiffs of carbon dioxide to stimulate coughing and deep breathing every hour for twenty-four hours, when the patient is awake
4 Check femoral, popliteal and ankle pulses every hour
5 Give Demerol, 25 mg , every three hours, only after patient is awake and increase the dosage only if absolutely necessary
6 Apply continuous Wangensteen suction, irrigate every four to six hours, with sterile saline solution
7 Give nothing by mouth, moisten lips and mouth with ice chips
8 Keep the patient in the oxygen tent and give Alevaire if needed
9 Administer fluids intravenously the first day Usually 1000 cc of glucose and water are required every eight hours, adding saline solution to replace loss through gastric aspiration on the second and third day One gram of sodium iodide should be added to each bottle the first day to encourage the loosening of mucus
10 Keep intake and output chart
11 Have hemoglobin and hematocrit determinations made in the afternoon following operation and repeated the following morning
12 Have electrolyte studies made daily or every other day, as required Potassium chloride is added to the fluids if gastric aspiration is necessary over many days
13 Irrigate Foley catheter with saline solution twice a day
14 The patient is permitted to dangle his feet over the edge of the bed on the fourth or fifth day, as a rule
15 Give fortified Crysticillin, 600,000 units, intramuscularly, on the morning of surgery and daily thereafter Combiotic is used in some patients

The Levin tube is usually placed while the patient is asleep in the

Ligation and Stripping of Varicose Veins

The essential points in the preoperative evaluation of the advisability of ligation and stripping of varicose veins center around the age and general health of the patient Most patients tolerate this surgery quite well It is very important in older patients to know the exact status of the arterial circulation Patients with arteriosclerosis obliterans and any degree of arterial insufficiency probably should not have an extensive ligation and stripping Patients with severe fungus infection should be treated adequately before surgery of the varicose veins, an elective procedure, is attempted Fungus infection in the groin, particularly in very obese individuals, should be treated first

Preparation of the entire lower extremity and pubic, suprapubic and groin area is very important prior to operation for varicose veins The entire area should be shaved on the morning of surgery and scrubbed with soap and water Marking of the veins, particularly in patients with numerous varicose masses or perforators, is important Various dyes, such as brilliant green, will be washed away by the soap and water preparation Pyrogallic acid solution, which contains 0 5 gm of pyrogallic acid, 50 cc of acetone, 40 cc of ferric chloride solution, and sufficient ethyl alcohol to make 100 cc, has been used Perhaps the best marking, and the one preferred by us, is that made by the back of a scalpel blade or a point of a needle, a slight scratch mark being placed at the exact site where the incision will be made

Strict attention, during operation and following stripping of the veins, to evacuation of all the blood from under the skin through the incisions and prompt wrapping of the leg with pressure dressings will reduce the possibility of hematoma formation in the thighs and legs Also, elevation of the legs at the time of stripping aids in lowering the incidence of this hematoma formation

Postoperatively, the orders are essentially those for relief of pain Although the advisability of early ambulation is debatable, most surgeons get the patient out of bed and have him walk late on the day of operation and usually have the patient walking about ten minutes out of every hour Tensor elastic bandages usually are wrapped from the toes to the midthigh before the patient leaves the operating room These are left in place until the day after operation, at which time the legs are re-wrapped to just below the knees When the patient is walking about it is necessary to re-wrap the legs frequently to assure proper support, since the bandages often loosen The sutures are usually removed on the seventh postoperative day

The main complication to watch for postoperatively is constriction due to too tight wrapping of the tensor bandage at the time of operation,

We do not favor the use of general vasodilators, such as nicotinic acid, or procaine given intravenously A continuous caudal anesthesia which has been used prior to the operation may be maintained to serve as a good means of vasodilatation If the procedure has been started prior to the use of anticoagulants, it is a safe one We do not advocate repeated lumbar blocks following arterial embolectomy in a patient who is on anticoagulants, unless a catheter is used in the region of the sympathetic ganglion for injection of procaine Papaverine is used at the time of surgery and also postoperatively A very simple and effective means of obtaining reflex vasodilatation is that of placing of hot water bottles around the abdomen and chest of the patient Hematoma formation may occur in the wound when heparin is employed, but it has never been a severe problem in patients having arterial embolectomy It is important to determine the coagulation time and prothrombin time daily, since a cardiac patient may be extremely sensitive to heparin, and one or two doses in some patients have extended the clotting time to an hour or beyond General measures directed to support of the heart, of course, are indicated as well as digitalization when required, since many of these patients are suffering some degree of decompensation at the time of operation The success obtained in many of these patients is dependent on the rapid initiation of cardiac compensation

When an embolism has occurred at the aortic bifurcation, a somewhat different problem is present First of all, these patients are usually more acutely ill than are those having an embolus in an artery and, in order to do the embolectomy, spinal anesthesia or general anesthesia is usually necessary For this reason, it is especially important to make every effort to get the patient in the best state of cardiac compensation possible prior to surgery It is also extremely important to regulate the anticoagulants at the very optimum level

Resection of Femoral Artery and Replacement by Graft or Bypass Procedure

These patients, as mentioned before, are not given anticoagulants postoperatively They usually require no special care in a general sense They are given fluids intravenously on the day of surgery, and usually can take fluids and food by mouth on the second or third postoperative day The essential point in the care of these patients is keeping the patient at bed rest with his legs level for a period of four to five days until some healing has occurred Particular attention is paid to watching the pulses at the ankle for any signs of occlusion of the graft Besides thrombosis of the graft, the other outstanding complication is hemorrhage, which rarely occurs

Chapter 19

PEDIATRIC SURGERY

JOHN L KEELEY, M D

PEDIATRIC SURGERY cannot be accurately defined Its scope varies from one institution to another, depending upon precedent, case selection—either planned or circumstantial—the architectural set-up, and the various surgical specialties represented in the training of the available personnel and their particular interests One point, however, is certain, that the care of pediatric surgical patients, whether in the preoperative period or throughout the postoperative course, demands its own exclusive hospital area where special equipment and trained personnel are available The importance of an adequately trained house staff cannot be underestimated and in the care of no other group of surgical patients will the lavish use of skilled special nursing be as rewarding

While infants have no choice but to accept the care provided for them because of their limited ability to protest, older children respond in one manner or another to the ministrations of those in attendance The initial psychic preparation usually sets the pace for all subsequent procedures It establishes a pattern of response which the child can then feel is expected of him His good initial performance can be cited to him as the expected standard of his behavior in subsequent situations One must have a real affection for children and must not be annoyed in any way by the distress shown by a frightened or uncomfortable child Yet a firm manner is necessary to carry out essential procedures, and preliminary assurance and explanation enable one to retain the patient's friendship and confidence

Much has been written concerning the psychological preparation for a child's admission to the hospital for surgical treatment It is quite obvious that a child's anxiety can be increased if his parents are greatly concerned and show it in their behavior Children take courage from those about them and an air of confidence shown by parents is an essential beginning The

resulting in coldness and numbness of the feet The patient's feet should be observed closely the first few hours following operation for this complication and the bandage re-wrapped when necessary The second complication, a rare one, is that of hemorrhage, often what appears to be bleeding is only the old blood from the stripping escaping through the wounds The third complication to watch for is any undue swelling and the appearance of any deep phlebitis

ANTICOAGULANT THERAPY

Anticoagulant therapy has been referred to in a number of places in this chapter Although there are many recent long-acting anticoagulants, the most commonly used one is still Dicumarol Heparin should be used in any patient as an immediate means of producing an anticoagulant effect It is used alone on occasions, particularly when further surgery may be anticipated and when one does not wish to operate with the hazard attending possible long-acting anticoagulants The patient being placed on anticoagulant therapy should have Lee-White coagulation time and prothrombin time determinations made The usual dosage of heparin, which may be given intravenously or deep subcutaneously, is 50 mg every four hours The Lee-White coagulation time is determined daily approximately two and one half to three hours following the last dose of heparin An effect of heparin on the coagulation time of from fifteen to thirty minutes is considered adequate Cardiac patients, particularly those in decompensation, may be very sensitive to heparin and show a marked prolonged coagulation time following just a few doses When one is starting the use of Dicumarol, *heparin is continued for forty-eight hours or more until the effect of* the Dicumarol is apparent In the patient with a normal prothrombin time, 300 mg are given the first day and 200 mg the second day, subsequent doses of from 50 to 100 mg a day usually maintain the prothrombin time from 20 to 40 per cent activity

Convulsions are usually associated with high fever in infants and children, but brain damage due to hypoxia, edema, hemorrhage, or thrombosis must also be considered as etiological factors Adequate sedation with phenobarbital is indicated, but reduction of fever is imperative and intravenous fluid administration should be discontinued if cerebral edema from overhydration is suspected Dehydration by hypertonic solutions of dextrose, plasma or albumin may be necessary

In the operating room the temperature may rise when heat dissipation is decreased by the drapes (which should therefore be light) and the use of a closed anesthesia system The use of multiple ice bags properly insulated to diffuse the cold and to prevent fat necrosis may be effective in decreasing temperature and metabolism in a febrile patient A pediatric surgical patient with a normal temperature, on the other hand, may lose body heat rapidly if unduly exposed because of the relatively greater surface area per unit of body weight Loss of body heat is greater in a premature infant than in a full-term baby because of the former's limited vasomotor control and almost complete lack of insulating subcutaneous fat Exposure of a large area in the process of skin preparation is obviously to be avoided A suitable warmed wrap before and after operation will aid in maintaining normal body temperature

ANESTHESIA

We use local anesthesia rarely in infants and children and, in most instances, when it is employed, in conjunction with general anesthesia to decrease the amount of the latter necessary Suitable preoperative psychological preparation, premedication to allay anxiety, or the induction of actual somnolence by giving Pentothal rectally prevents the distressing situation in which a crying or screaming child is forcibly taken from the arms of his

Premedication in Infants and Children

AGE	WEIGHT IN LBS	DEMEROL (MG)	MORPHINE SULFATE (GRAINS)	ATROPINE (GRAINS)	PREFER SCOPOLAMINE (GRAINS)	NEMBUTAL (GRAINS)	SECONAL (GRAINS)
Up to 2 mo	7–10		None	1/400–1/300	1/650		
2–4 mo	10–14		None	1/300	1/450	1/1[illegible]	
4–6 mo	14–16		None	1/300	1/450	1/12–1/8	1/4
6–12 mo	16–22		None	1/300	1/450	1/8	1/4–3/8
12–18 mo	22–25	12 5	None	1/250	1/400	1/8 –1/4	3/8–1/[illegible]
18–24 mo	25–27	20	1/72	1/250	1/400	1/4	3/8–1/2
2–3 y s	27–30	20–25	1/48	1/200	1/300	1/4 –1/2	3/8–3/4
3–5 yrs	30–40	25–30	1/48	1/200	1/300	1/2	3/4
5–8 yrs	40–55	30–40	1/36	1/150	1/150	1/2	3/4–1
8–10 yrs	55–65	40–45	1/24	1/150	1/150	1/2 –3/4	3/4–1
10–12 yrs	65–80	45–50	1/18	1/150	1/150	3/4 –1	1
12–14 yrs	80–90	50–60	1/12	1/100	1/150	1–1 1/2	3/4–1 1/2
Adult	Over 90	50–100	1/8–1/4	1/75	1/150 1/100	1–1/2	1–1/2

parents should be prepared to answer the child's questions in a straightforward manner, using simple, nonmedical terms In fact, the answers the child receives from parents, doctors and nurses should relate the same simple but essential facts Widely varying answers may be interpreted as deception by an apprehensive youngster

In discussing proposed procedures with children the use of nonmedical terms is essential The child need be told no more than he can understand, but in words he can understand How much better it is to say that his tonsils are to be "pinched out" than cut An abdominal operation may be minimized by the term "a mark on your tummy," or "having something fixed " In other respects, however, children must be treated as older individuals and above all must never be deceived

The hospital will be less strange if the child is permitted to bring along something from home—a favorite toy, a familiar robe, an old pair of slippers—or perhaps something new which has been promised to him to "celebrate" the occasion of his entrance into the hospital Children take courage readily from other children and, therefore, the ward or cubicle arrangement has many advantages Thus, he receives all necessary attention but no more than he needs He sees children about him recover and go home, and senses that he is merely awaiting his turn to be dismissed It is this atmosphere which makes hospitalization twenty-four hours or so before the time scheduled for the child's operation a distinct advantage over his entrance on the morning of surgery

PREOPERATIVE CARE

Good preoperative care includes measures designed to reduce problems during anesthesia and also in the postoperative period Fever, which *raises the normally high rate of metabolism in young patients,* may be decreased advantageously in several ways and should be brought down to within two degrees of normal, if possible, prior to operation for an inflammatory lesion Sponging with tepid water or alcohol is effective in most cases Aspirin, in doses ranging from 50 mg for infants to 600 mg for twelve-year-olds, may be given every two to four hours for three or four doses Many causes of fever prevent the use of aspirin orally, but the drug may be given rectally in the same dosage Sodium salicylate may be given intravenously in doses of 0 5 to 1 0 gm Correction of dehydration, which will be discussed later, may be the most important factor in controlling fever Specific antibiotics given in combination with the above measures may make a dramatic change and the benefit to be derived from sponging, fluids, salicylates and antibiotics often justifies the delay of an operation for several hours

nurse's opinion of his strength, the vigor of his cry and mild changes in skin color which reflect the efficiency of capillary circulation become important guide posts

POSTOPERATIVE CARE

The discussion of surgical pediatrics to be presented here will cover the recovery room management of surgical patients exclusive of neurosurgical, plastic and orthopedic problems It cannot include all of the situations encountered in every surgical procedure involving the neck, chest and abdomen, but general principles and many specific problems in relation to these regions will be discussed

Adequate Airway

The first obligation of the recovery room to pediatric surgical patients is to *guard against the danger of sudden death* This risk is far greater in infants and children than in adults The most immediate and important problem is the maintenance of an adequate airway It is understood that no patient would have been transferred from the operating room unless the airway and the general condition of the patient were satisfactory The development of laryngeal edema due to an irritating or oversized endotracheal tube or obstruction due to the aspiration of even small amounts of gastric content may cause a fatality In infants, the air passages are so small they can be obstructed by a few drops of blood or a small mucous plug In general, noisy respiration means some degree of obstruction Quiet respiration is usually associated with an adequate airway, but an infant with a completely obstructed airway and no audible respirations can have sufficient movement of the soft chest wall to deceive the unwary observer

If obstruction is due to aspirated material, the time-honored maneuver of suspending an infant or child by his feet when something goes "down his Sunday throat" is often effective in clearing the airway At the same time it increases venous return and provides more efficient cerebral circulation, forestalling medullary failure which, in the final analysis, is the cause of death in asphyxia It can be used should there be any delay in tracheal intubation

External compression of the trachea due to edema or hematoma may occur after operations in the neck or mediastinum In comparison with adults, the higher metabolism, greater oxygen need, and proportionately much smaller tidal volume and residual air increase the hazards of even transitory tracheal obstruction in young patients The effect of hypoxia on the myocardium is much more severe in infants and children than in older

parents and whisked off to the operating room still protesting in his most effective and efficient way If, following this, the child is forcibly restrained on the operating table while laryngospasm is induced in response to inhalation agents used in high concentration for rapid induction of anesthesia, hypoxia must certainly result This, plus fever, dehydration, acidosis and an increased amount of circulating adrenaline can undoubtedly set the stage for such complications as cardiac arrest or so-called ether convulsions in a sick child inadequately prepared for anesthesia and operation The goal, therefore, should be a smooth induction in a calm or slightly drowsy patient

As a general rule, we prefer ether as the anesthetic agent, given by the open-drop method, with oxygen flowing into the mask continuously Just enough anesthetic to permit the operation to be performed is used and no more This allows the patient to awake in the operating room or shortly after his transfer to the recovery room It is assuring to parents to see their child either awake or obviously in the process of awakening To the physician it means that protective reflexes, particularly in relation to respiration, are returning Endotracheal anesthesia may be desirable and even necessary in neurosurgical or thoracic procedures, operations performed with the patient in the prone position and in patients in whom the aspiration of gastric or other secretions might occur during or immediately after anesthesia

NUTRITION

Metabolic needs of infants and children are two to three times greater per unit of body weight, owing to relatively greater body surface and to high metabolic rates, than are those of adults The increased metabolic activity of these little patients, however, is also associated with rapid healing in a rapidly growing organism On the other hand, anemia, hypoproteinemia, dehydration and malnutrition can develop rapidly and demand correction preoperatively after even short periods of severe illness In the postoperative period, owing to increased losses and inability to take nourishment orally, energetic correction of these deficiencies may be the key to the recovery in what appears to be an irreversible situation It must be remembered that relatively more water is required in infants than in older patients because of the poorer power of renal concentration in the former group

In addition to the evaluation of the pediatric patient s condition based on weight, fluid intake and output, caloric requirements and blood chemistry determinations, many decisions must be made on findings which cannot be measured Thus, the general appearance of an infant, an observant

Endobronchial aspiration in atelectasis, decompression in pneumothorax, or suprasternal incisions for relief of mediastinal emphysema may be necessary

Abdominal Distention

Respiratory distress may also be due to abdominal distention Meteorism is not liable to develop rapidly in the postoperative period, but can do so in patients receiving oxygen by nasopharyngeal catheter Large amounts of oxygen may be swallowed because of intrapharyngeal pressure Continuous or intermittent gastric aspiration will control abdominal distention, as a rule. For this purpose a soft no 8 F catheter may be used for premature infants and a size or two larger for full-term infants Intermittent insertion of the catheter may be preferable, since respiratory embarrassment occurs

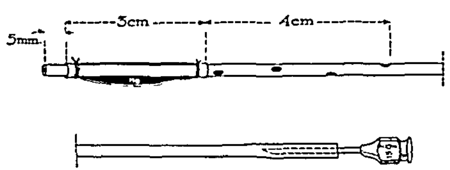


Fig 1 Diagram showing details of construction of so-called long tube for intestinal decompression in infants

with the tube in place continuously On rare occasions the so-called "long tube" for direct intestinal decompression may be necessary One can be made (Fig 1) as suggested by Sugarman and Swenson The materials needed are 3 feet of polyvinyl tubing no 8 F, a 15-gauge needle, a thin small finger cot, fine braided silk (5–0) and 1 cc of mercury The tip of the polyvinyl tubing is made smooth by rotating it for an instant in a flame A suitable portion of the finger cot is used to contain the mercury and is held in place about the tube with the fine silk, air having been excluded before the second winding of silk is put in place A high concentration of oxygen (90 to 95 per cent) in the inspired air will aid mobilization of the inert nitrogen from the bowel and provides increased oxygen uptake, which is generally helpful in respiratory embarrassment The gastric tube may be removed when the aspirate is no longer bile-stained but is clear Intestinal tubes should be removed when distention has subsided, peristalsis is re-established and flatus is passed or bowel movements have occurred

subjects In some instances, a minor change in the position of the head may angulate and obstruct the trachea We have seen this factor as a threat to life in an infant for three weeks following excision of a massive cystic hygroma

To cope with the emergency of an obstructed airway, materials and equipment for prompt tracheal intubation and controlled respiration must be immediately at hand at all times An assortment of laryngoscopes and endotracheal tubes of suitable sizes should be arranged on a tray so that the appropriate one can be promptly selected as soon as the towel covering them is whisked off It is worth while to remember that endotracheal catheters have long been inserted by digital guidance in the newborn This method may be used in an emergency if there is delay in acquiring a laryngoscope, if the instrument fails to function, if the first person to see the patient is not experienced in its use, or if there is difficulty in visualizing the larynx

Once the tube is in place, suction should be used for only the instant necessary to clear the passages, since prolonged endotracheal suction results in rapid lowering of the oxygen saturation of the blood Inflation of the lungs can then be done by attaching the cannister and bag, but it can also be accomplished by mouth in desperate cases and when there may be some delay in connecting suitable apparatus The force used in this "controlled respiration" should be determined by a water manometer contained in the circuit, the pressures should not exceed 10 cc of water Pulmonary trauma, tears and leaks can thus be avoided

Tracheotomy may be necessary should endotracheal intubation be unsuccessful or because of the sheer urgency of laryngeal obstruction It may be elected after successful intubation when repeated tracheobronchial aspiration is necessary Secretions may be removed by simple catheter aspiration through the tracheotomy tube A high concentration of oxygen, antibiotics and mucolytic agents may be administered directly via this convenient route

Thoracic Complications

Thoracic complications such as atelectasis, pneumothorax, and emphysema, both mediastinal and parietal, are not common, but may be only slightly less urgent than laryngeal or tracheal obstruction

Older children will move about spontaneously enough to prevent atelectasis and hypostatic changes, but the position of infants must be changed frequently to provide adequate bronchial drainage, unless contraindicated by the nature of the operation In addition to the physical signs suggesting thoracic complications, debatable findings may be properly evaluated by x-ray studies Appropriate therapy may be instituted promptly

accelerate absorption from these sites Fluid administered subcutaneously is unsatisfactory for severely dehydrated patients because of the unpredictability in the rate of absorption It may be too slow when fluids are needed, and unusually rapid absorption later may overload the circulation

Intravenous therapy is so urgently needed in many phases of surgical care that special emphasis is placed on the details of "cut-down" technique so often necessary for infants and young children and desirable in older children requiring prolonged intravenous therapy The selection of a

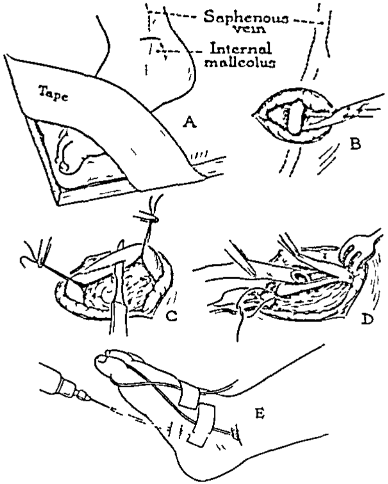


Fig 3 Steps in cannulating the saphenous vein at the ankle

suitable vein is often the key to success One must consider the relative importance of each cut-down If several are likely to be needed in the pre- or postoperative period, the best vein should be saved for the day of operation Figure 2 shows the location of available venous channels Puncture of the sagittal sinus or jugular vein has long been done to obtain blood samples, but neither vessel is suitable for prolonged intravenous therapy, the former because of its anatomical location in relation to the brain and both

Parenteral Therapy

Because many surgical diseases in infancy and childhood interfere with or contraindicate oral intake, provision for hydration, nutrition and transfusion must be made

Fluid and, to a degree, electrolyte balance may be maintained by the subcutaneous injection of physiological solution of sodium chloride or a mixture of equal parts of such solution with one containing 5 per cent

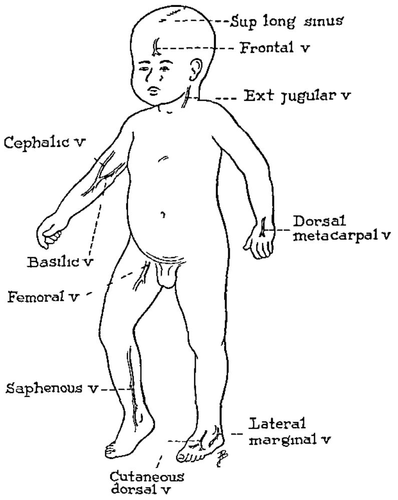


Fig 2 Vessels accessible for intravenous therapy in infants and children

dextrose in distilled water This form of treatment may be useful in correcting moderate disturbances in fluid and electrolyte balance when there is still a fair tissue turgor and when the carbon dioxide combining power is 15 mEq or above Sites for injection of either of these solutions are the scapular areas, where 25 to 30 cc can be placed in each side at one injection, and the anterolateral or anteromedial surfaces of the thighs, where fluids can be administered by the drip method Hyaluronidase may be used to

mits the introduction of a cannula or polyethylene tube larger than the lumen of the vein, owing to the dilating effect of the tapered tip Should the smallest available polyethylene tubing be too large for the largest available vein, stretching the tubing will decrease its diameter Its tip can be made smooth without closing it off by rotating it quickly in a flame for an instant The tubing should then be passed up the vein about half way to the next joint so that the tip lies free in the lumen without constant contact with the wall, thus avoiding irritation and possible phlebitis Should spasm of the vein occur, this can usually be overcome by the injection of 0 5 cc of 0 5 per cent procaine through the tube The spasm usually subsides in a minute or two

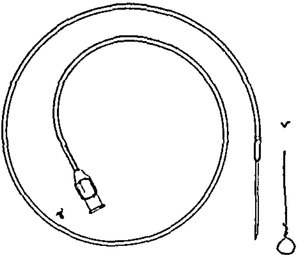


Fig 5 Plastic tube with needle tip and hub for intravenous infusion in small veins, such as those in the scalp or the dorsum of the hand

In patients whose veins are suitable and in whom intravenous therapy may be needed for a relatively short time the Gardner-Murphy needle* (Fig 5) may be a satisfactory substitute for a "cut-down" It can be fastened in place much easier than the conventional needle, adapter, and tubing arrangement, and often can be used for two or three days

Proctoclysis has very little indication It is an uncertain source of fluid, the amount retained may be calculated, but the amount absorbed is still undetermined

A bone marrow transfusion may be used in an emergency by introducing a suitable needle into the tibial diaphysis

Serious water and electrolyte imbalances can occur rapidly in children, particularly in those below the age of three and especially in premature infants The ordinary causes, such as unusual fluid losses and restriction of

* May be obtained from Randall Faichney Corp , Boston, Mass , U S A

because of difficulties in the fixation of needles In general, the best sites are at the ankle or the antecubital fossa This provides at least four sites if none is damaged by poor technique The saphenous vein at the level of the ankle is most commonly used It may be sought against the firm background of the malleolus, whereas the veins in the antecubital fossa must be "fished" for in a surrounding of soft fat in the proximity of important deeper structures which can be damaged or mistaken for a vein

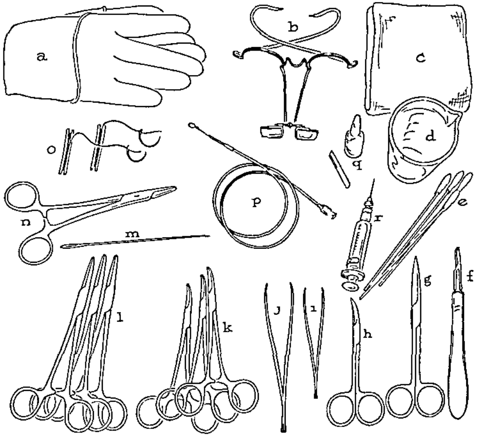
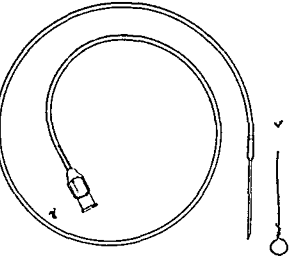


Fig 4 Pediatric cut down set a, Gloves, b ocular loupe, c, towel, d medicine glass, e, cotton applicators, f scalpel, g, straight scissors h, curved scissors, i, small tissue forceps j, large tissue forceps k curved hemostats, l, straight hemostats, m, straight needle n, needle holder, o, sutures with needles, p, polyethylene tubing q, local anesthetic, r, hypodermic syringe

Figure 3 shows the steps in exposing, opening and cannulating a vein This method can be used for any available vein, but the illustration shows the saphenous at the ankle being used Figure 4 shows the materials and equipment for the procedure Placed with this sterile set-up for purposes of illustration is a binocular loupe of the type used in ophthalmic surgery It is indispensable in opening and cannulating a tiny vein, often the best one available It magnifies the structures two and one-half times and per-

mits the introduction of a cannula or polyethylene tube larger than the lumen of the vein, owing to the dilating effect of the tapered tip Should the smallest available polyethylene tubing be too large for the largest available vein, stretching the tubing will decrease its diameter Its tip can be made smooth without closing it off by rotating it quickly in a flame for an instant The tubing should then be passed up the vein about half way to the next joint so that the tip lies free in the lumen without constant contact with the wall, thus avoiding irritation and possible phlebitis Should spasm of the vein occur, this can usually be overcome by the injection of 0 5 cc of 0 5 per cent procaine through the tube The spasm usually subsides in a minute or two



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fluid intake plus a surface area and metabolic rate two to three times greater per unit of body weight than adults, and the functional immaturity of infants' renal tissue make a potent combination of undesirable factors

There appears to be two generally accepted principles in fluid therapy in infants and children The first is the desirability of underhydrating surgical patients rather than overhydrating This is based on the common clinical experience that more patients are lost from excessive fluid than from underhydration The second principle is the avoidance of the use of excessive electrolytes because of the inability of the immature kidney to excrete them should an excess be given Furthermore, the limited cardiac reserve must be protected against overload caused by too rapid fluid administration or total amounts of fluid which are too large The relatively low plasma protein concentration in both premature and full-term infants makes them more susceptible to edema, which may involve cerebral, pulmonary or renal tissues in addition to the obvious increased fluid content of subcutaneous fat

Space does not permit the presentation of the details of fluid and electrolyte therapy, but the needs may be classified into three main categories

1 Maintenance—simple substitution of intravenous for oral intake
2 Maintenance plus abnormal losses—usually from the alimentary tract
3 Deficits—in addition to either of the above requirements

Thus, a patient may need therapy as indicated in one, two, or all three categories

Although fluid requirements have been expressed in amounts per unit of body weight it is becoming more generally recognized that the better guide is the surface area of the patient Many excellent current presentations are available which have succeeded in summarizing the many factors upon which fluid therapy is based so that workable tables and rules are clearly presented A recent commercial guide contains tables which determine surface area in infants and children from weight alone Surface area based on height and weight may be derived from DuBois' nomogram which is presented in many standard pediatric textbooks Butler's figures indicate the daily needs per square meter of surface as follows

Water	1500 cc
Sodium	30 mEq
Potassium	20 mEq

Thus, a patient weighing 5 kilograms having a surface area of 0 3 square meters would require 450 cc of 5 to 10 per cent dextrose in distilled

water, 9 mEq of sodium as sodium chloride and 6 mEq of potassium as potassium chloride in a twenty-four-hour period

If gastrointestinal losses are also to be replaced, an equal amount of a solution of 1000 cc of 5 or 10 per cent dextrose in distilled water which also contains 135 mEq of sodium chloride and 15 mEq of potassium chloride would be necessary Thus, if the same patient lost 100 cc of fluid through gastric suction he would require 100 cc of the above solution containing 13 5 mEq of sodium chloride and 1 5 mEq of potassium chloride

For the correction of deficits an initial hydrating solution of 5 per cent dextrose in 0 33 per cent sodium chloride solution may be used in quantities of 50 ml per square meter of body surface given in a period of one hour This solution contains no potassium because *potassium should not be given until adequate renal function has been determined or established* The amount of water and sodium initially given is subtracted from the calculated twenty-four-hour requirements The remainder of the calculated water and electrolyte requirement can then be given in the next twenty-four hours in the form of 10 per cent dextrose or fructose in distilled water, containing the remainder of the calculated sodium and potassium needs By giving the daily amount of potassium slowly over a period of twenty-four hours and only after urinary function has been established, the dangers of hyperpotassemia are avoided

Although the amount of fluid is calculated for twenty-four hours, it should be given in two or preferably three interrupted periods If only a third or a half of the daily requirement is placed in the suspended flask, the hazard of overhydration from running the full amount in too rapidly will be avoided The effect of each portion should be assayed to determine the necessity of speeding up, or, more often, slowing down the rate of administration or the need for altering the composition of the solution

Fluid and electrolyte therapy must be guided by appropriate studies Determinations of chloride, carbon dioxide combining power, sodium, potassium, and urea nitrogen are required frequently in patients with severe fluid and electrolyte imbalance

In addition for the need of water, dextrose, and sodium chloride, some patients may require plasma or blood The former may be given daily in amounts not exceeding 20 ml per kilogram of body weight Blood in similar amounts may be used instead of plasma if the erythrocyte count falls below 4,000,000 or the hemoglobin concentration is less than 9 gm

Vitamin Therapy

Vitamin therapy in patients of this age group is limited to the use of vitamin K for the control of hemorrhagic tendencies and vitamin C to

promote wound healing and tissue repair The maintenance dose of vitamin C in infants is 25 to 50 mg daily, but doses of 250 to 500 mg may be given orally or by subcutaneous injection when the processes of tissue repair need substantial support The effect of vitamin C on capillaries may be beneficial in patients with hemorrhagic tendencies Any excess of this vitamin will, of course, be excreted in the urine Therefore, large doses can be used safely Vitamin C may be combined with vitamin B complex and given intravenously in conjunction with fluids for hydration

Sedation and Analgesia

Sedatives and analgesics may be necessary for a child who is apprehensive, hyperactive, or in pain Neither should be used in newborns, but at six months, phenobarbital or Nembutal may be used in doses of 25 to 30 mg every six to eight hours as required Approximate doses of these and other drugs in different age groups may be determined from the following summary

	DOSE RANGE	AGE RANGE
Phenobarbital or Nembutal	50 to 200 mg	1 year to 12 years
Morphine sulfate	1 0 to 8 0 mg	1 year to 12 years
Demerol	10 to 50 mg	1 year to 12 years

Thus, a six-year-old child might be given half the dose of the twelve-year-old and children of other intervening ages would receive proportionately more or less Beyond question it is safest to order sedatives and analgesics as needed, because the hazards of overdosage are so great and the end result so potentially disastrous Furthermore, a child who requires medication of this kind is usually one who should be seen frequently by the resident Ordering medication by the single dose as needed is one way of insuring frequent visits and observations

Urinary Retention

Urinary retention is a rare postoperative complication in infants and children Because of its low incidence it may be overlooked As in adults, it occurs more frequently in males than in females Acute urinary retention may occur after abdominal or perineal operations and is due to sphincter spasm It may be associated with such rare conditions as stenosis of the bladder neck in either sex or posterior urethral valves in males Less prominent symptoms due to such abnormalities may go unnoticed until retention becomes complete following an unrelated surgical procedure or a medical illness A diaper constantly wet from overflow of urine may be misinterpreted as evidence of normal bladder emptying Fullness and dullness on percussion in the lower abdomen should make one suspect urinary retention, just as these findings do in adults When urinary reten-

tion is suspected, heat applied to the lower abdomen or perineum by compress, water bottle, irrigation, or sitz bath, depending on the location of the operative site and stage of healing, may be used to stimulate urination

The diagnosis is established by catheterization, which may also abolish sphincter spasm and re-establish normal urination The catheter should be well coated with a water-soluble lubricant and may range from no 6 to 12 F, depending on the size of the patient The mucosa of the male urethra may be split longitudinally if an oversized catheter is forced along its lumen In males, if the catheter seems rigid or appears to meet an obstruction in the posterior urethra, it is advisable to insert a finger into the rectum to guide the catheter safely along the membraneous portion of the urethra If repeated catheterization is found necessary, an indwelling catheter should be used It should be small enough so that it does not overdistend the urethra and should be replaced every two or three days to avoid "catheter urethritis," prostatitis and epididymitis

Dressings

Dressings for a surgical wound or lesion should protect the area adequately and should be applied in such manner that they remain in place until removed by a member of the professional staff Some special problems arise in the dressings used for the pediatric surgical patient Areas must be protected from saliva, spilled feedings, urine, feces, discharges from adjacent draining sinuses or fistulae and, of course, from the prying, persistent and sometimes phenomenally ingenious hands of a small patient Since the most common means of fastening dressings in place is by adhesive tape, we have adopted the routine use of compound tincture of benzoin as a protection for the skin and to make the tape adhere firmly Dressings are kept in place on extremities much easier if splints are used in conjunction with them

It seems reasonable to expect an abdominal dressing to afford some support, but it should not be so tight as to interfere with abdominal respiration It may be adjusted if distention develops or increases Unless drainage is anticipated, there should be a minimum of gauze dressing Overlapping adhesive strapping should extend from the posterior axillary line on each side It is placed on a coating of tincture of benzoin which has been allowed to become "tacky"

Wound Complications

Wound complications are rare In adbominal surgery, dehiscence, one of the most serious, will be decreased by the use of transverse or gridiron incisions In paramedian incisions, displacing the rectus muscle laterally instead of splitting it permits the intact muscle to be interposed between

suture lines as the closure is accomplished Dehiscence is heralded by the drainage of sufficient yellow or amber fluid to wet the dressing in much the same manner as in adults with this complication The diagnosis is verified by inspection of the wound If the sutures have been removed, loops of bowel may protrude The treatment, resuture of the incision, should be accomplished promptly Gastrointestinal decompression should be a part of the treatment as distention is almost always associated with dehiscence Through-and-through sutures of nonabsorbable material should be arranged so that loops of dilated bowel do not rest against taut segments of exposed suture material and lead to pressure necrosis of the bowel To avoid this usually fatal complication, through-and-through sutures should exclude the peritoneum or should be installed in a manner which ensures firm contact between peritoneal surfaces by everting at least the inner layers of the wound

Should evidence of wound infection develop, prompt treatment with warm, moist compresses should be started The removal of a few skin sutures may provide drainage Cultures and sensitivity tests should be made promptly so that specific antibiotic therapy may be instituted early

Vascular Complications

Thromboembolic disease is uncommon in infants and children, probably because of the high rate of metabolism and the natural tendency for these patients to practice early ambulation Phlebitis, due to the presence of a polyethylene tube for two or three days, may develop but it is not serious as a rule and subsides soon after the tube is removed In patients with cyanotic heart disease, dehydration and polycythemia due to gastrointestinal disorders may be associated with thrombosis, and, in some instances, gangrene is the final result

In this presentation of pediatric surgery emphasizing postoperative care, only the most common problems have been discussed Space does not permit an exhaustive work nor a discussion of differing viewpoints It is believed that the material presented here will be of immediate practical value and will form a basis for understanding the postoperative care of the pediatric surgical patient

Such subjects as preoperative medication, the details of oxygen therapy, use of a variety of drugs, and management of infant feeding, omitted in this section, are presented in other chapters Undoubtedly there will be much information in other sections of a book of this type which can be helpful in the care of the pediatric surgical patient The contents of this chapter are considered to be a summary of care which is basic and practical

Chapter 20

MANAGEMENT OF MEDICAL PROBLEMS

EDWARD J WISS, M D

In this chapter will be considered therapy of patients having medical emergencies of such character that the patients are best handled in a post-operative recovery room with its well-trained personnel, special equipment and drugs, and constant surveillance It is obvious that in a book of this scope one has to be arbitrary at times When a controversial issue is concerned, the conservative, time-tested, practical approach will be favored The pathophysiology of the disease will be considered only insofar as rational approach to therapy makes this relevant Further, this section is not intended to serve as a complete medical emergency room manual—there are innumerable available Rather it deals with some of the more complex medical problems requiring more extensive laboratory and clinical studies than are usual An attempt has been made to present the material in a comprehensive form without introducing complexities which would interfere with decision and prompt, effective therapy

CARDIAC EMERGENCIES

Cardiovascular Drugs

It is important to remember that cardiac drugs may initiate the very arrhythmias they are designed to prevent, particularly in toxic dosage The drugs should be used orally whenever possible, and in the lowest effective dose Clinical evidence indicates that procaine amide has a lower therapeutic ration than does quinidine Reported clinical results in the treatment of arrhythmias are unreliable as these states are unstable and frequently

the additive action of the drugs used in succession is overlooked, e g , the effectiveness of procaine amide after "failure" of quinidine The occurrence of sudden death, agranulocytosis and aplastic anemia is still reported following the use of cardiac drugs, particularly quinidine and procaine amide Test doses do not rule out entirely the possibility of untoward reactions occurring However, bold, intensive therapy must be pursued to save lives when clear-cut indications exist An electrocardiogram must be obtained before the use of any cardiovascular drug, for accurate diagnosis, to rule out contraindication and to evaluate the effect of the drug

CARDIAC DRUGS *Quinidine Sulfate* The therapeutic effect and blood level reach a maximum two hours after an oral dose Cumulation occurs but is limited When this drug is administered every two hours, peak concentration is reached after the fifth dose, thereafter intake equals disposal With intervals of four to six hours, peak concentration may not occur for two to four days Blood concentration of 6 to 8 mg per liter will usually convert auricular flutter or fibrillation to sinus rhythm Data are not available for ventricular arrhythmias, but clinical experience indicates that they respond to relatively small doses Blood levels of over 10 mg per liter are occasionally necessary to convert an arrhythmia, but at this level there is a high incidence of toxic effects The determination of blood levels is also helpful in ruling out the possibility of malabsorption

The individual dose of quinidine sulfate is between 0 2 and 0 6 gm and depends on the weight of the patient Doses are given at intervals of two hours for five doses, during daytime only, or at 4-hour intervals around the clock The individual dose may be increased by 0 2 gm each day until as much as 3 3 to 4 0 gm is being given per twenty-four hours With doses over 1 2 gm per twenty-four hours, electrocardiographic reading should be made as a check at frequent intervals *During intravenous therapy* a continuous electrocardiographic record should be made and the blood pressure should be checked frequently Quinidine widens the QRS complex, and its administration should be stopped if this complex becomes 0 11 second or more in duration This drug should be used with extreme caution if at all in auriculoventricular or bundle branch block Concurrent use with digitalis should be avoided Administration of quinidine should be interrupted if extrasystoles occur, particularly if they had not been present previously They are usually of ventricular origin This drug has a vagolytic action in therapeutic dosage that abolishes the effect of carotid pressure It also has a sympatholytic action which causes vasodilation Symptoms of toxicity are nausea, emesis, blurring of vision, headache, tinnitus, vertigo, deafness, and marked hypotension Indications for parenteral therapy are vomiting, coma, anesthesia, and when action is urgent, e g , in ventricular tachycardia Parenteral dosage follows

Quinidine Gluconate (Lilly)—Supplied 0 8 gm in 10-cc vial

Intramuscularly, give test dose of 2 0 cc (0 16 gm) If there is no untoward effect and arrhythmia remains unchanged, give up to 0 5 gm and give repeat dose of 0 1 gm as often as every two hours

Intravenously, before use, dilute solution by adding 10 cc (0 8 gm) to 50 cc of 5 per cent glucose solution Inject slowly with an intravenous drip apparatus up to 10 cc (approx 0 5 gm), taking about ten minutes (rate of about drop per second), under electrocardiographic and blood pressure control

Quinidine Hydrochloride (Brewer)—Supplied 0 6 gm in 5 0-cc vial

Intramuscularly, give 0 45 to 0 6 gm (3 75 to 5 cc) Repeat at two hour intervals if necessary

Intravenously, before use, dilute the 5-cc vial containing 0 6 gm with 55 cc of 5 per cent dextrose solution Administer by intravenous drip up to 50 cc at the rate of 5 cc (75 drops) per minute, under electrocardiographic and blood pressure control

Pronestyl Hydrochloride Pronestyl Hydrochloride (Squibb) (procaine amide hydrochloride) is supplied in capsules of 0 25 gm and in 10 cc vials containing 100 mg per cc Clinically and experimentally, procaine amide has been found to be about one-quarter to one-third by weight as potent as quinidine Therefore, the two compounds may be substituted for one another according to the rule that 0 25 gm (1 capsule) of procaine amide is equivalent to 0 065 gm (1 grain) of quinidine The action of procaine amide on the heart is similar to that of quinidine Nausea, vomiting, headache and diarrhea occur frequently when the oral dose exceeds 4 0 gm per day (equivalent in cardiac action to 1 0 gm of quinidine) Procaine amide appears, then, to be more toxic than quinidine Many hypersensitivity reactions have been reported as in quinidine therapy, e g, agranulocytosis, aplastic anemia, fever However, there does not appear to be a cross sensitivity, and therefore the two drugs can be substituted for one another without interruption of the schedule The additive action may contribute to success Intravenous administration should be under blood pressure and electrocardiographic control It cannot be said that procaine amide is safer or more effective than quinidine in the treatment of the ventricular arrhythmias

Dosage—Orally, 500 mg (2 capsules) are given every four to six hours, according to response In urgent cases, 1 0 gm (4 capsules) may be given followed by 0 5 to 1 0 gm every four to six hours

Intravenously, 200 to 1000 mg (2 0 to 10 0 cc) may be given slowly at a rate not to exceed 200 mg per minute (2 0 cc) under electrocardiographic and blood pressure control and stopping when arrhythmia is controlled

Digitalis This drug has a direct suppressive action on ectopic centers and readily abolishes extrasystoles and tachycardias It may rarely convert

flutter or fibrillation to sinus rhythm Its ability to prolong A-V conduction is valuable in controlling effects of rapid ventricular activity in auricular tachycardias On the other hand, it is notorious for its propensity to provoke ventricular extrasystoles, tachycardia and, ultimately, fibrillation It may rarely cause auricular extrasystoles, tachycardia, or fibrillation In treatment of the arrhythmias it must be made certain that digitalis is not causing them Ventricular extrasystoles and tachycardias caused by digitalis are multifocal (continuous change of form of QRS) and auricular tachycardias show A-V block They may persist for weeks after use of the drug is discontinued Ordinarily the clinician is advised to learn to use one of the preparations However, in an emergency situation, the particular drug may

Digitalis Preparations, Actions and Dosage

	DIGITAL—WHOLE LEAF	DIGITOXIN	LANATOSIDE C	GITALIN	DIGOXIN
Preparations	D galen (Hoffmann La Roche) Digitol (Sharpe & Dohme) Digifolin (Ciba) Digifortis (Parke Davis) Digitalis Leaf (Burroughs Wellcome)	Digitaline Nativelle (Varick) Purodigin (Wyeth) Crystodigin (Lilly)	Cedilanid (Sandoz)	Gitaligin (White)	Digoxin (Burroughs Wellcome)
Average dose					
Digitalization					
Intravenous	0 3–0 4 gm	1 0–2 0 mg	1 6 mg	4 5–5 5 mg	1 0–1 5 mg
Oral	1 5 gm.	1 0–2 0 mg (< 24 hrs)	7 5–10 0 mg (72 hrs)	6 0 mg (60 hrs)	1.5–2 0 mg (< 24 hrs)
Maintenance	0 1 gm	0 1–0 2 mg	0 5–1 6 mg	0 5 mg	0 5 mg
Action (single digitalizing dose)					
Oral					
Onset	3–4 hrs	2–4 hrs	Variable	2–4 hrs	1 hr
Maximal effect	12–36 h s	9–24 hrs	24–48 hrs	—	6 hrs
Dur tion	48–72 hrs	48–72 hrs	24 hrs	24–72 hrs	24–48 hrs
Parente al					
Onset	1–2 hrs	1/2–2 hrs	10–30 mins	none available commercially	10–30 mins
Maximal effect	12–24 hrs	8–9 hrs	2 hrs		2 hrs
Duration	48–72 hrs	36–48 hrs	24 hrs		24 36 hrs

not be obtainable Because of the confusion arising from the great number of preparations on the market, a table is presented summarizing the preparations available, their actions and the dosages An electrocardiogram must be made before the drug is given The digitalizing dose may be administered at once, if the need is urgent and it is absolutely certain that no digitalis has been given in the previous two weeks Preferably, however, one-half to two-thirds of the digitalizing dose is given at once, then one-sixth to one-third at intervals of two to four hours until the desired effect is obtained or mild signs of toxicity appear If the need is not urgent and oral administration is feasible, the maintenance dose may be given every four to six hours until therapeutic effect is obtained or mild toxicity is manifest, in the average patient, ten doses will be required In the extreme emergency

situation in which minute to-minute control is necessary, such as during surgery, acetyl strophanthidin or ouabain is recommended

Acetyl Strophanthidin and Ouabain These drugs act within one to three minutes, have their peak effect in ten to fifteen minutes, and an appreciable duration of action up to four hours

Dosage of acetyl strophanthidin (intravenous)—In patients having had no digitalis for two weeks, 0 6 mg is given followed by 0 2 mg every ten to fifteen minutes until the desired effect is obtained Dilution is not necessary if injection is made over at least a two minute period Caution is necessary in patients who have received ephedrine, quinidine, cyclopropane, or Pentothal

Dosage of ouabain (intravenous)—The digitalizing dose is 0 8 to 1 0 mg, given in divided doses The initial dose is 0 5 mg, then 0 1 mg is given every one-half to one hour until the desired effect is obtained If digitalis has been given in the previous two weeks, the initial dose should be 0 2 mg

Indications for Digitalization in the Operating or Recovery Room These are listed below

Myocardial damage after cardiac resuscitation
Shock refractory to usual therapy
Congestive heart failure, with or without associated myocardial infarction
Dyspnea or bronchospasm of cardiac origin, even without obvious failure
Tachycardias—auricular fibrillation, auricular flutter, sinus and nodal tachycardia, if there is a suspicion of antecedent cardiac disease
Cyanosis unrelieved by adequate ventilation with oxygen, particularly in patients with cardiac disease
Cardiac enlargement or electrocardiographic evidence of left ventricular strain before or during thoracic surgery

ANTICOAGULANTS *Heparin* This drug is used in the treatment and prevention of thromboembolic disease either continuously or for three to four days until other anticoagulants, such as Dicumarol, attain therapeutic effect It is available in soluble and repository forms

Dosage—Soluble form Intravenously, 100 mg are given every four to six hours, or by continuous infusion at the rate that will give about 400 mg in twenty four hours Intramuscularly, 100 mg are given every six to eight hours

Repository form When the body weight is 150 lb or less, 30,000 USP units (approx 300 mg) are given every twelve to twenty-four hours When the body weight is over 150 lb, 40,000 USP units (approx 400 mg) are given every twelve to twenty four hours

The dosage is adjusted according to the clotting time The normal Lee-White clotting time is nine to fifteen minutes and safe effective levels of heparin activity occur when the clotting time is thirty to sixty minutes

Contraindications—blood dyscrasias manifesting hemorrhagic tendencies, postoperatively when there is poor hemostasis (especially prostatic, liver, brain and spinal cord surgery), and in the presence of active gastrointestinal ulceration, malignant hypertension, or subacute bacterial endocarditis

Dicumarol (3,3'-Methylenebis [4-Hydroxycoumarin]) This drug is used in the prevention and treatment of thromboembolic disease There are a number of similarly acting anticoagulants such as Tromexan, Danilone and Hedulin (reference should be made to the literature for the respective dosages) There are claims for these of advantages of more rapid action, dissipation and greater safety, but Dicumarol has stood the test of time It is supplied in tablets of 25, 50 and 100 mg

Dosage—200 to 300 mg are given on the first day, 100 to 200 mg on the second day, and 50 to 200 mg daily thereafter, according to the prothrombin time which should be kept within two to three times the normal control, or between 20 to 30 per cent prothrombin activity

A prothrombin time must be determined before initiation of therapy, and daily thereafter until the use of Dicumarol has been discontinued for at least four to five days and the prothrombin time has returned to normal

The contraindications are those listed for heparin and, in addition, significant renal or hepatic disease

VASOPRESSOR AGENTS These should be used with great caution in the presence of hyperthyroidism, severe hypertension and coronary artery disease

Ephedrine Sulfate This is given subcutaneously or orally

Dosage—Orally 4 to 25 mg are given three to four times per day, subcutaneously 0 015 to 0 03 gm

Isuprel Hydrochloride (Isoproplyarterenol Hydrochloride) Glossets of 10 0 and 15 0 mg are supplied for sublingual use, and a 1 200 solution for testing the response

Dosage—Give 0 2 mg intravenously to test the response If successful, give one sublingual tablet (10 or 15 mg) every two to four hours, as necessary

Levophed (Noradrenalin, Norepinephrine) For dosage of this drug the section on the treatment of shock should be consulted (Chapter 3)

Neosynephrine Hydrochloride (Phenylephrine Hydrochloride) This is supplied in 1 0-cc ampules of 1 0 per cent and 2 0-cc ampules of 0 2 per cent solution

Dosage—Intramuscularly, 0 1 to 1 0 cc of the 1 per cent solution (1 0 to 10 0 mg) is given The initial dose should not exceed 0 5 cc (5 0 mg) and subsequent injections should not be given oftener than every ten to fifteen minutes Increases should not exceed the preceding dose by more than 0 05 to 0 1 cc (0 1 to 0 2 mg)

Intravenously, the initial dose should not exceed 0 25 cc (0 5 mg) of a 0 2 per cent solution The dose should not be increased by more than 0 05 to 0 1 cc (0 1 to 0 2 mg) and never exceed 0 5 cc (1 0 mg)

Paredrine Hydrobromide (Hydroxyamphetamine Hydrobromide) This is employed orally and parenterally

Dosage—Orally, 20 to 40 mg are given every four hours as necessary

Intramuscularly, the dose is 10 to 20 mg

Intravenously, the dose is 5 to 10 mg

Vasoxyl Hydrochloride (Methoxamine Hydrochloride) This is supplied in 1 0-cc ampules containing 20 mg of the drug

Dosage—15 0 mg are given intramuscularly, 5 0 mg intravenously For hypotension associated with myocardial infarction, administration in dextrose or normal saline solution by slow intravenous drip is recommended

Wyamine Sulfate (Mephentermine Sulfate) This is supplied in vials of 1 or 10 cc containing 15 0 mg

Dosage—Initially, 15 0 mg are injected slowly intravenously For maintenance, 5 0 to 15 0 mg are injected intramuscularly at intervals of two to four hours, or 35 to 70 mg are given in 100 cc of 5 per cent glucose in water by slow intravenous drip, taking one to two hours for the infusion

VASODEPRESSOR-PARASYMPATHOMIMETIC DRUGS These include Mecholyl and Prostigmin

Dosage of Mecholyl (acetyl beta-methylcholine)—20 to 40 mg are given subcutaneously Extreme caution must be used The patient must be supine and atropine sulfate (1 0 mg) must be ready for intravenous injection if cardiac standstill or marked hypotension occur

Dosage of Prostigmin (neostigmine)—1 0 cc (1 2000) (0 5 mg) is given, intramuscularly Prostigmin Methylsulfate is supplied in 1 0-cc (1 4000) ampules containing 0 25 mg and 1 0-cc (1 2000) ampules containing 0 5 mg

*Arrhythmias**

EXTRASYSTOLES (AURICULAR AND VENTRICULAR) These are benign if infrequent, but when they occur in an operating or recovery room may portend the onset of more serious arrhythmias, and frequently will require specific therapy if they become frequent or occur in runs Quinidine is given unless there is obvious myocardial insufficiency, in which case digitalis is indicated

PAROXYSMAL AURICULAR TACHYCARDIA The predisposing factors are tobacco, alcohol, coffee, toxic doses of quinidine or digitalis, congestive heart failure, coronary disease and myocardial infarction, hyperthyroidism, fatigue and emotion

Treatment consists in mechanical measures—carotid sinus pressure, ocular pressure, the Valsalva procedure and induction of emesis—and drug therapy, employing quinidine, Pronestyl or digitalis In refractory cases, one of the following may be tried

Prostigmin Methylsulfate—1 to 2 cc of 1 2000 solution injected intramuscularly

Neosynephrine—Inject rapidly intravenously and observe the blood pressure carefully Success of this method depends on the sudden rise in blood pressure

Vasoxyl—This is a pressor amine Five to 10 mg in 20 cc of normal saline solution are given intravenously slowly

Mecholyl—This is reserved as a last resort

AURICULAR FLUTTER This is serious because of rapid ventricular rates (150 or above) and of the fact that there is usually serious underlying heart disease

The heart rate is slowed by digitalization Normal sinus rhythm or auricular fibrillation ensues If there is no serious underlying heart disease, the fibrillation is converted to sinus rhythm with quinidine

AURICULAR FIBRILLATION When the condition is chronic it is treated with digitalis Do not attempt to covert with quinidine or Pronestyl, for it will probably be impossible to maintain normal sinus rhythm if conversion is successful, and the sinus rhythm is prone to be rapid and difficult to slow down, and there is risk of embolization When it is paroxysmal it is treated with Pronestyl or quinidine The possibility of hyperthyroidism should be ruled out

* For dosages of drugs referred to in sections below on the treatment of arrhythmias, heart failure, thromboembolic disease and other conditions, see preceding pages of this chapter

VENTRICULAR TACHYCARDIA Treatment is urgent, for complications are prone to arise These are congestive heart failure, coronary, cerebral, or peripheral arterial insufficiency, and cardiac standstill or ventricular fibrillation The treatment of choice is quinidine therapy If no response to this drug is obtained, Pronestyl is given If congestive heart failure is present, conversion is accomplished with above agents first, then the patient is digitalized Occasionally morphine sulfate (15 mg) or magnesium sulfate (2 to 4 gm), given intravenously, is successful in resistant cases

VENTRICULAR FIBRILLATION If the chest is open, an electric defibrillator and other measures described under cardiac arrest are employed In nonsurgical patients, quinidine is given intravenously under careful electrocardiographic control This a serious and frequently pre-terminal manifestation of the circulatory system Pronestyl may be tried if quinidine is ineffective

HEART BLOCK *First Degree* Heart block of the first degree may be present in normal hearts, particularly in those of athletes It may be a sign of early digitalis or quinidine toxicity The possibility of rheumatic fever activity should be ruled out No treatment is necessary for this arrhythmia per se

Second Degree This may be a sign of digitalis or quinidine toxicity Treatment is necessary only for underlying heart disease, if present

Third Degree Treatment is given for this only if the inherent ventricular rate is too slow (30 or less), or if Adams-Stokes attacks occur when complete A-V block is periodic and the ventricular pacemaker is tardy in taking over (transient cardiac standstill) Treatment consists in giving of 0 032 gm ephedrine three to four times per day, orally, or 0 015 to 0 03 gm subcutaneously as often as every two to four hours in emergency situations Adrenalin (epinephrine) (1 1000) may be given (0 3–1 0 cc) intramuscularly However, the pressor amines are contraindicated in the patients in whom the Adams-Stokes attacks are due to attacks of ventricular tachycardia or fibrillation An electrocardiogram must always be obtained and an accurate diagnosis made if possible Aminophylline, 0 5 gm , given either slowly intravenously or by suppository, is frequently found beneficial in Adams-Stokes attacks and accurate diagnosis in the emergency situation is not then urgent Atropine, formerly very popular, is not advised in treatment of heart block, for with increase of auricular rate the degree of heart block may be increased

Acute Congestive Heart Failure

FORMS Acute, predominantly right or left ventricular failure or combined forms occur From the standpoint of the acute emergency,

especially in the operating or recovery room, acute left ventricular failure, or pulmonary edema, is the important type, therefore, consideration will be largely limited to treatment of this form Pulmonary edema is predisposed by hypertensive heart disease, acute myocardial infarction and aortic valvular lesions The synonyms are "cardiac asthma" and "paroxysmal nocturnal dyspnea"

TREATMENT OF ACUTE LEFT VENTRICULAR FAILURE (PULMONARY EDEMA) *Posture* The posture most comfortable to the patient is employed—usually the "orthopneic" position

Narcotics Morphine sulfate, 8 0 to 32 0 mg, according to age, weight, and clinical state, is the drug of choice unless there is known sensitivity or hypothyroidism Demerol may be used in comparable dosage (usually 50 0 to 150 0 mg) If the indication is urgent and subcutaneous absorption would be delayed, the dose is administered slowly, intravenously Morphine has a salutory hemodynamic action over and above its action to allay apprehension and distress The maximal effect by the intravenous route is attained in fifteen to twenty minutes The smaller doses may be repeated at intervals of ten to fifteen minutes to a total maximum dose of 30 mg Preferably, the dose should be diluted in 5 to 10 cc of water and given slowly The total dosage in twenty-four hours should not exceed 60 mg Certainly, excessive respiratory depression should be avoided in pulmonary edema

Oxygen Oxygen must be bubbled through water to avoid irritation of the dry gas

When a mask is used for the administration, 100 per cent oxygen is given, after reassuring the patient and adjusting the flow gently Therapy is started at the rate of 15 liters per minute, so that there is no resistance with first breaths The flow is reduced gradually so that the bag is always partly full at the end of inspirations The flow should correspond to the liters per minute which the patient is breathing The dyspneic patient ventilates at the rate of 12 to 18 liters per minute One may be guided by the degree of distention of the bag The flow is reduced to 6 to 8 liters per minute as the patient improves Under these conditions the patient will receive approximately a 95 per cent concentration of oxygen

When a nasopharyngeal catheter is employed, 100 per cent oxygen, given at the rate of 6 to 8 liters per minute, will give concentrations of 30 to 50 per cent oxygen, varying with the volume of respiration

Oxygen given through an oropharyngeal catheter at 6 to 8 liters per minute will give a 50 to 70 per cent oxygen concentration *Caution* The possibility of aerophagia should be guarded against

The administration of oxygen in a tent is the least desirable, since 50

per cent oxygen concentrations are maintained only with expert care The tent is unhandy for treatment and observation It does have the advantage of keeping the patient cool in hot weather

Wetting agents such as Alevaire, or the bubbling of the oxygen through an ethanol solution, have value in thinning bronchial secretions, and improving gaseous exchange across the alveolar membrane

Paradoxical hypoxia is a condition that is not rare and one important to recognize in patients receiving oxygen therapy Carbon dioxide has lost its driving action on the respiratory center, leaving only the anoxic stimulus Obviously, giving oxygen to these patients will further depress respiration and cause "narcosis" of hypercapnia Oxygen must not be forced on a patient if dyspnea is not improved, and if the patient becomes more cyanotic and lethargic during this therapy

Aminophylline (Theophylline Ethylenediamine) In the treatment of left ventricular failure, this drug is of much value through its inhibition of reflex bronchospasm and also through its effect on the kidney to increase renal blood flow and glomerular filtration, favoring diuresis It is given intravenously in dosage of 0 25 to 0 5 gm , diluted to a volume of about 20 cc (5 per cent dextrose in water), slowly over a period of five minutes It may also be given in concentrated form by deep intramuscular injection, but this is frequently painful, and, in this type of patient, absorption tends to be delayed

Reduction in Venous Load Tourniquets may be used to reduce the venous load They should be applied to the extremities close to the trunk tightly enough to obstruct venous return, but not arterial flow They should be released for two minutes every fifteen minutes

Reduction of the venous load may also be accomplished by venesection Two hundred and fifty to 750 cc of blood are withdrawn into a sterile donor vacuum bottle under sterile technique, so the blood may be returned in whole or part, if needed

"Rebound hyperemia" may occur 30 minutes to two hours after removal of tourniquets and lead to circulatory embarrassment Significant anemia is a contraindication to venesection, in fact an occasional patient will require a washed red-cell transfusion to stabilize the circulation

Digitalis Except in patients with arrhythmias that have precipitated the attack, digitalization should be employed after the application of the above-described procedures Digitalization should be effected rapidly by the intravenous route, as outlined under the cardiac drug section of this chapter If the indication is very urgent, ouabain or acetyl strophanthidin should be used

Mercurial Diuretics These may be given during the process of

digitalization, not primarily for treatment of the acute episode, but as a prophylaxis against further attacks Mercuhydrin is given in total dosage of 2 0 cc, intramuscularly or intravenously, after a test dose of 0 5 cc given intramuscularly Thiomerin is given in the same dosage subcutaneously or intramuscularly

Vasopressor Agent Moderate depression of blood pressure (100/70 to 80/50 mm Hg) usually improves within an hour following the above-described measures Depression below 80/50, especially in the older and severely ill patient with marked oliguria or anuria, should be treated with vasopressor agents (with caution!) Norepinephrine (Levophed) may be used (see treatment of shock), as well as the other vasopressor agents listed under cardiac drugs, such as Neosynephrine, Isuprel, Vasoxyl, or Wyamine

Other Measures After the acute attack the usual measures used to combat chronic congestive heart failure should be used as prophylaxis These include salt restriction (0 5 to 1 0 gm sodium diet), acidifying salt and xanthine diuretics, restriction of activity, and the like

Acute Myocardial Infarction

NARCOTICS These are given as described for the treatment of acute pulmonary edema

VASODILATORS Aminophylline (theophylline ethylenediamine) may be employed In acute phase, 0 5 gm is given intravenously every 4 to 6 hours slowly, after this, 0 1–0 2 gm is given four times a day orally, if tolerated An intramuscular preparation is also available, but this causes pain at the site of injection Papaverine hydrochloride may be given rather than aminophylline The dose is 0 03 to 0 06 gm, given intravenously or intramuscularly every 4 to 6 hours As soon as feasible, shift is made to the oral dose of 0 1 to 0 2 gm four times daily

DIGITALIS Use of the drug is indicated only in patients with congestive heart failure or arrhythmia with a rapid ventricular rate (See section on cardiac drugs For additional measures in the face of congestive heart failure, see the appropriate foregoing section) Some authorities recommend antibiotics when pulmonary edema occurs

ANTI-ARRHYTHMIC DRUGS Some authorities advocate the routine use of quinidine or Pronestyl in myocardial infarction Certainly, most of these patients get along well without them The average prophylactic dose of quinidine is 0 3 gm given three to four times per day Of course, in patients in critical states and those with frequent extrasystoles, the anti-arrhythmic drugs should be given For active treatment of the arrhythmias the appropriate section should be consulted Complete heart block complicating myocardial infarction rarely requires treatment

ANTICOAGULANT THERAPY Some authorities advise the routine use of anticoagulant therapy for all patients having acute myocardial infarction Many recommend it only in poor-risk patients, such as those with gallop rhythm, cardiomegaly, serious arrhythmia or tachycardia, congestive heart failure, shock, those past 50 years of age, those with a history of a previous attack or a history of thromboembolic disease, or the like The procedure and contraindications are described under anticoagulant therapy in the cardiovascular drug section of this chapter One of the most important contraindications is absence of a reliable laboratory to follow the prothrombin and coagulation times If decision is made to use anticoagulants, therapy with heparin should be started together with Dicumarol (or similarly acting compound) after the basal prothrombin and coagulation times have been determined The use of heparin may then be discontinued in three to four days when Dicumarol has attained its therapeutic level

OXYGEN Oxygen therapy is indicated in patients with acute myocardial infarction who have congestive failure or shock, cyanosis, dyspnea (with or without cyanosis), and severe persistent pain (though of questionable value in the latter) (The section on oxygen therapy in congestive heart failure should be consulted)

TREATMENT OF SHOCK (CARDIOGENIC, DUE PRIMARILY TO LOW CARDIAC OUTPUT) Shock associated with acute myocardial infarction is diagnosed by the clinical picture It must be differentiated from simple congestive failure, which usually will be associated with pulmonary and/or peripheral edema, cardiomegaly, hepatomegaly with hepatojugular reflux, and jugular vein distention, and frequently there will be a history of previous attacks of decompensation "Shock" will not be associated with these conditions unless there is concomitant failure The low level of blood pressure will be helpful in the differentiation, however, the antecedent level has to be considered In patients with shock, usually the pulse pressure is less than 25 mm , and there is marked oliguria or anuria A retention catheter should be employed in these patients and antibiotics given prophylactically The catheter allows accurate intake-output evaluation and prevents obstructive uropathy, particularly in patients of the older age group with prostatic hypertrophy aggravated by the supine position

If the possibility of congestive heart failure can be ruled out, venous infusion may be in order, using a small quantity of fluid—glucose solution in particular and occasionally normal saline solution Vasopressors are indicated Levophed is given in conservative dosage, maintaining the blood pressure at the lowest level that will keep the patient out of shock The other vasopressors may be used cautiously, e g , methoxamine, mephentermine and phenylephrine

DIET A light, liquid diet (e g , Karell diet—200 cc of milk every four hours) may be used, as soon as tolerated, for about twenty-four hours, then a soft solid diet with moderate restriction of salt, is given

GENERAL MEASURES *Bed Rest* Some authorities recommend "arm-chair treatment" except in patients in shock Most allow commode privileges from the onset It has been proved that less energy is expended in using the commode than in using the bed pan

Bowels Care Mild laxatives in adequate amounts are given for at least the first few days to avoid strain on the circulation during defecation

Pulmonary Embolism-Thrombophlebitis

The predisposing conditions include cardiac disease, operations (the complication may occur one day to one month postoperatively), neoplastic disease (predisposes to phlebitis, especially carcinoma of the pancreas), varicose veins, pregnancy, and trauma and infection of the lower extremities

The prophylactic treatment consists in prevention of damage to the vein intima (atraumatic surgery, prevention of infection, avoidance of pressure on the veins), prevention of circulatory stasis (maintenance of good fluid balance, avoidance of shock, use of leg bandages for varicosities, elevation of lower extremities without pressure in the popliteal area, use of early ambulation, promotion of deep breathing exercises, avoidance of ileus and abdominal compression) Phlebitis should be detected early and treatment instituted promptly

TREATMENT OF PHLEBITIS The surgical treatment depends upon the level involved Bilateral superficial femoral vein division, common femoral vein division and vena cava ligation, according to the level of the thrombus, may be performed If there is evidence of arterial spasm, a lumbar sympathectomy should be performed

The medical treatment consists in the use of heparin and Dicumarol (or related drug) therapy, as described on page 497 Recently the intramuscular injection of trypsin has been attended with some favorable results, according to reports in the literature, at least in respect to alleviation of the acute symptoms and signs

TREATMENT OF THE PULMONARY EMBOLISM PER SE In most cases of pulmonary embolization a small embolus or a number of small emboli are present Large emboli cause sudden death The treatment rests primarily on prophylaxis

Oxygen therapy may be given as described for the treatment of acute pulmonary edema, morphine also may be employed as described for that condition Stellate ganglion block may be beneficial if a surgeon competent to perform it is available Papaverine may be used for its vasodilatory effect

It is given by slow intravenous infusion in dosages of 0 06 gm Caution must be employed when this treatment is used in hypotensive patients Atropine, administered hypodermically in doses of 0 5 to 1 0 mg, is used to block bronchospasm and combat excessive bronchial secretions Thoracocentesis is employed in patients with significant pleural effusion secondary to pulmonary infarction The pleural effusion may actually be due to acute congestive heart failure superimposed upon pulmonary embolism

Antibiotics are used prophylactically, since infarcted tissue, susceptible to infection and pneumonia, is a hazard in the pain-splinted thoracic cage

Digitalis is employed in the patients who have congestive heart failure, particularly those with cor pulmonale due to multiple previous emboli

TREATMENT OF VENOUS THROMBOTIC DISEASE ASSOCIATED WITH EMBOLIZATION This is the same as that described for phlebitis

Hypertensive Crises

It is important to be certain that a hypertensive crisis is not a premonitory sign of acute myocardial infarction or congestive heart failure, or a manifestation of a cerebrovascular accident (traumatic or spontaneous)

There are a number of relatively new drugs, such as Apresoline, hexamethonium, pentamethonium, Hydergine and protoveratrine, that may be given for the treatment of hypertensive crises The literature should be consulted for the dosage of these drugs They must be used with caution, particularly in patients with coronary artery disease and those who have had previous cerebrovascular accidents, since they are extremely potent hypotensive agents

The regimen for the use of Intravenous Solution Veriloid, a veratrum viride derivative, will be presented here This preparation is recommended because of its proved clinical value, relative safety and wide application, such as in eclampsia, in which therapy with the other drugs has not been well defined It is supplied in 5 0-cc ampules containing 0 4 mg of Veriloid per cubic centimeter of the solution with a 20 0-cc diluent ampule Quinidine therapy is a relative contraindication in its use, while the presence of pheochromocytoma and coarctation of the aorta are absolute contraindications

PROCEDURE FOR USE OF INTRAVENOUS SOLUTION VERILOID The blood pressure is checked at least once per minute Infusion is discontinued if gross irregularity of the pulse develops or emesis occurs (particularly if these have not been present prior to therapy)

1 Draw into a 10-cc syringe 0 15 cc of solution (0 4 mg per cc) for each 10 pounds of body weight Dilute this to 10 cc with normal saline or a 5 per cent dextrose solution

   a Give at the rate of 0 5 cc per minute, for eight minutes (total 4 cc)
   b Wait two minutes
   c Continue administration at the rate of 0 5 cc per minute for six more minutes (total 7 cc)
   d Wait two minutes
   e Continue at the rate of 0 5 cc per minute for six more minutes, checking the blood pressure closely Interrupt the administration whenever the blood pressure (systolic, diastolic, or both) falls 20 mm Hg

2 Allow two minutes for stabilization of the blood pressure at the new level and then proceed with a second course over a period of twenty minutes Continue only until a reasonable blood pressure is reached, e g , 150/100

3 When desired blood pressure is reached there are two courses of action
   a The effect may be maintained by slow intraveous infusion for periods up to many days The dosage for this purpose is 0 6 cc of the undiluted solution (0 24 mg) per 10 pounds of body weight, added to a liter flask of dextrose solution and given at the rate of 30 drops per minute The effective dose does not exceed 100 cc per hour in most patients At this point the blood pressure need be checked only about every ten to fifteen minutes
   b Allow the blood pressure to return to hypertensive level (usually occurs in one and one-half to three hours) and then the initial procedure outlined above is repeated until reflex adjustment occurs and previous high levels are not achieved Up to six courses may be necessary The treatment is then changed to suitable oral therapy If this is not feasible, Intravenous Solution Veriloid may be given by stomach tube, in a dosage range from 9 to 15 mg (22 5 to 37 5 cc of undiluted Intravenous Solution Veriloid)

Side effects include epigastric or substernal burning, salivation, nausea and emesis Overdosage leads to hypotension, collapse and marked bradycardia Ephedrine sulfate, 1 0 cc of a 2 5 per cent solution (3/8 grain), given intramuscularly, combats hypotension, and atropine sulfate solution, 0 4 mg (1/150 grain), given intramuscularly, overcomes the bradycardia

CEREBROVASCULAR ACCIDENTS

Hemorrhage

Cerebral hemorrhage usually occurs as the result of hypertension, frequently associated with cerebral arteriosclerosis It may occur in the

absence of hypertension, as a result of rupture of a congenital aneurysm Of course, hypertensive patients may have aneurysms and the elevated blood pressure may favor rupture Further, in a given patient seen in the emergency room whose history is not obtainable, the blood pressure has limited diagnostic value, as elevation frequently occurs as a manifestation of brain injury

Thrombosis

Thrombosis occurs in the cerebral arteries manifesting arteriosclerosis The patients tend to be normotensive, but occasionally have moderate elevation of blood pressure The acute thrombosis tends to take place at night while the patient is in bed, because of hemodynamic conditions such as those operative in coronary thrombosis

Embolism

Cerebral embolism may result from dislodgement of a thrombus on the mitral valve in a patient with subacute bacterial endocarditis, or dislodgement of a mural thrombus in a patient with acute myocardial infarction Extremely rare are emboli emanating from the peripheral veins or right side of the heart that move to the left side through a septal defect (paradoxical embolism)

Treatment

Rational therapy depends on accurate diagnosis of the type of lesion Thrombosis and embolism indicate vasodilation (neurological and drug) and anticoagulation, whereas in hemorrhage these measures are contraindicated Also, the current opinion is that anticoagulants are contraindicated in subacute bacterial endocarditis, with or without embolization The crux of the matter then is the differential diagnosis between hemorrhage on one hand and thrombosis-embolism on the other Favoring the diagnosis of hemorrhage are a long history of marked hypertension, a sudden acute attack (few, or no, premonitory signs or symptoms), deep coma, and absence or paucity of localizing signs

General Measures Irrespective of type of lesion the following measures are taken

1 Sedation is used sparingly to control only marked degrees of restlessness or convulsions Paraldehyde (8 0 to 16 cc), chloral hydrate (0 6 gm) (rectally), or Luminal Sodium (0 06 to 0 12 gm) (administered intramuscularly), may be given every three to four hours, if necessary
2 Antibiotics are given as a prophylactic measure against hypostatic pneumonia and urinary tract infection A broad spectrum agent,

such as Achromycin (250 mg every six hours) or penicillin (repository) (400,000 units daily) with streptomycin (0 5 gm), once or twice daily, should be employed

3 The patient's head is kept elevated about 45 degrees and to the side to avoid further elevation of intracranial pressure and aspiration The patient is turned from side to side every two hours to disfavor hypostatic pneumonia

4 Oxygen therapy is given, particularly in dyspneic, cyanotic patients, and in those with Cheyne-Stokes respiration Patients in the age group of those subject to cerebrovascular accidents frequently have cardiac disease and may benefit from oxygen therapy

5 An open airway is maintained by keeping the jaw forward, and suctioning secretions (deep suction, employing a thin, soft rubber catheter, is necessary)

6 In comatose patients a retention catheter is placed in the bladder

7 Nutrition should receive no particular concern for the first twenty-four hours Following this, proper fluid, caloric, and electrolyte balance is maintained

8 The possibility of complicating a disease, such as diabetes, uremia, or myocardial infarction (it is not rare for an attack of cerebral thrombosis or embolism to be precipitated by this latter condition), must be ruled out

9 Accurate record of vital signs, blood pressure, and intake-output is maintained The blood pressure and vital signs should be recorded at least every one to two hours during the acute phase

SPECIFIC MEASURES *Thrombosis and Embolism* A stellate ganglion block, performed by a competent surgeon, may be indicated, this treatment may be repeated every six hours, if necessary, during the first twenty-four hours

When ganglion block is not feasible, it is advisable to give 400 to 500 mg of procaine, in 500 cc of normal saline solution, intravenously over a period of two hours, this treatment may be repeated every four hours, if necessary, during the first twenty-four hour period

Anticoagulant therapy, employing heparin or Dicumarol, may be given, if the possibility of hemorrhage can be ruled out If there is a question regarding the diagnosis, it is best to avoid this therapy

Hemorrhage In the presence of cerebral hemorrhage, only the general measures listed above are employed, except that hypotensive agents should be given in addition when the blood pressure is dangerously high (see section on the treatment of hypertensive crises)

Ruptured Cerebral Aneurysm When a ruptured cerebral aneurysm is suspected, a neurosurgical consultation is indicated The general measures outlined above should be employed Angiography and surgical intervention are usually deferred for ten to fourteen days

MASSIVE GASTROINTESTINAL HEMORRHAGE

General Considerations

Massive gastrointestinal hemorrhage presents one of the most urgent problems in medicine for collaboration between internist and surgeon Its most common cause is peptic ulcer, accounting for about 75 per cent of the cases The next most common is bleeding esophageal varices The latter together with gastritis and malignant disease accounts for another 20 per cent This narrows the differential diagnosis down markedly, from the probability standpoint, however, in an individual case one has to consider the gamut of possibilities A list of the major possibilities follows

Esophagus—varices, peptic ulcer, neoplasm, mediastinal neoplasm, diverticulum, foreign body

Stomach—peptic ulcer, neoplasm, corrosives, hiatus hernia, gastritis, portal hypertension, foreign bodies, ruptured blood vessel (severe emesis), arteriosclerotic aneurysm, prolapsed gastric mucosa, lymphoma

Duodenum—peptic ulcer, neoplasm, cholecystoduodenal fistula

Small intestine—marginal ulcer, intussusception, mesenteric thrombosis, neoplasm, peptic ulcer of Meckel s diverticulum, regional enteritis, diverticulosis, dysenteries (typhoid ulcer), hemangioma

Large intestine—neoplasm, diverticulitis, polyposis, ulcerative colitis, uremic colitis, infections

Nongastrointestinal—blood dyscrasia, hemophilia, avitaminoses K and C

A complete history and physical examination must always be obtained Hematemesis indicates bleeding at a rapid rate, from as low as the duodenum and occasionally lower Bright red blood coming from the rectum usually means bleeding low in the intestinal canal, but occasionally it may be due to gastric bleeding if there is vigorous peristalsis As little as 75 cc of blood can cause tarry stools, following massive bleeding such stools may persist for five days after the bleeding has stopped The stools may be positive for occult blood for two to three weeks The blood urea nitrogen (B U N) is a better index of the rate of bleeding than the amount, for normal values may be found in patients with serious but slow bleeding In patients with serious bleeding, particularly in those in whom the differential diagnosis lies between ulcer of the stomach or duodenum and esophageal

varices, a Sengstaken or similar tube should be passed This serves two purposes tamponade of varices, if these are present, and location of the level of bleeding Determination of the bleeding time, clotting time, prothrombin time, hematocrit reading, urea nitrogen value, and serum protein value should be made at once Also a complete blood count should be made and a bromsulfalein test performed Blood volume studies and blood chloride and carbon dioxide determinations are of aid and should be carried out if facilities are available The blood pressure and vital signs should be charted every thirty minutes to an hour

The mortality figures, which are excessive, will be improved only by the medical-surgical team exercising the best judgment as to which of the subjects must be operated upon Invaluable aid is derived from x-ray studies and these are recommended as early as possible Since peptic ulcer is the commonest lesion, a regimen will be outlined for the treatment of this condition and criteria will be given for surgical intervention

Treatment of Bleeding Peptic Ulcer

The factors affecting prognosis in bleeding peptic ulcer are the age of the patient, the rate of bleeding, the duration of bleeding, the recurrence of bleeding, bleeding despite adequate medical therapy, and the general condition of the patient (diabetes, malnutrition, cirrhosis, coronary artery disease)

When shock is present, treatment should be instituted at once to combat it

Record should be kept of the therapy, laboratory studies, intake-output, vital signs and blood pressure, and the character of the stools with results of tests for occult blood when the stools are no longer tarry

Blood transfusion should be started immediately if the systolic blood pressure is 100 or below, or the hemoglobin value 70 per cent or less The amount of blood given and the rate of transfusion depend upon the condition of the patient The blood pressure should be maintained at about 110 The hemoglobin value should be kept at 60 per cent or above as a safeguard in event of recurrence of bleeding

The Sippy-type regimen of diet, with milk, cream, nonabsorbable antacids, and small feedings of food from the bland ulcer diet list, should be followed as soon as emesis has subsided

Drug therapy consists in the intramuscular injection of phenobarbital (60 0 mg every six hours) and Banthine (50 0 mg every six hours), or other antispasmodic, until food can be taken by mouth, at which time phenobarbital (30 mg) and Banthine (50 mg) are given orally four times a day

Surgical treatment is indicated (1) if the patient is over forty-five years of age, (2) when massive hemorrhage is indicated by the presence of hematemesis and melena and failure of the circulation to stabilize after 2000 to 2500 cc of blood have been given in a thirty-six-hour period and evidence of bleeding persists, (3) if hemorrhage recurs, and (4) in the absence of absolute contraindication for surgery, such as recent myocardial infarction or a previous history of bleeding disease

X-ray studies should be performed, if the diagnosis is not certain, when the patient is out of shock, and, preferably, circulation has been stabilized for twenty-four to forty-eight hours

INTOXICATIONS

The scope of this book does not allow consideration of an exhaustive list of intoxications The following few were selected because they are frequent, require more extensive clinical or laboratory study than do most emergency room problems, or require uncommon treatment

Barbiturate Poisoning

We are concerned here only with severe barbiturate poisoning, in which the patient is in coma or semicoma It is important to consider that the short-acting barbiturates are destroyed by the liver primarily, and that the long-acting are disposed of primarily by renal excretion Most patients do not take a lethal dose For most of the barbiturates, many authorities consider this dose to be 2 0 gm , or twenty, 1 1/2-grain capsules There are patients on record, however, who have survived doses of over 8 gm Obviously, these patients had vigorous and prompt treatment The important considerations are maintenance of an adequate airway, support of circulation, and maintenance of adequate renal excretion Analeptic drug therapy is of secondary importance, except perhaps in those patients having taken near lethal doses, and requiring periods of artificial respiration and support of the medullary centers

First of all the drug is removed by the usual measures of gastric lavage and magnesium sulfate catharsis

To maintain the airway in the comatose patient, intubation is performed by an experienced anesthetist Bronchial secretions are aspirated with a suction apparatus If bronchial plugs cause atelectasis, the patient is bronchoscoped, repeatedly, if need be Laryngeal edema should be watched for when the tracheal tube is removed A tracheotomy may be necessary

Pneumonia is prevented by instituting antibiotic therapy, elevating the foot of the bed, keeping the patient's head to the side to avoid aspiration, and turning the patient from side to side every two hours

A chart is kept of the progress The blood pressure, pulse, and respiration rates, temperature, and reflex activity (corneal, pupillary, deep tendon, gag, etc) are recorded at least every one-half hour The patient's condition must be checked constantly during the crucial hours

Oxygen is given through a nasal catheter at the rate of 6 liters per minute (see section on oxygen therapy) Artificial respiration may be necessary for periods of time in severe cases

A retention catheter is placed in the bladder Record is kept of intake-output

To maintain fluid balance a liter of normal saline in 5 per cent dextrose solution and 2 to 3 liters of 5 to 10 per cent dextrose in water, containing large quantities of vitamin B complex, are given during a twenty-four-hour period

Shock may develop insidiously and unpredictably while the patient is in deep coma Neosynephrine, Levophed, or plasma are employed to combat it

Analeptic drugs are used only if there is no response to painful stimuli and deep tendon reflexes are absent, unless there is evidence of very recent ingestion of a near lethal dose Caffeine sodium benzoate should be tried first in a dose of 0 5 gm , given intravenously or intramuscularly If some response is elicited, this treatment is repeated every one-half hour for 3 doses Benzedrine (10 mg) may be given every fifteen to thirty minutes until response is noted, then every one to two hours as necessary Picrotoxin (0 3 per cent solution, or 3 mg per cc) may be given in doses of 2 to 3 cc every fifteen to thirty minutes until response is noted, then every one to two hours as necessary Sufficient amount to cause extensive twitching or rigidity should not be given Convulsions may be delayed fifteen minutes after an injection They should be controlled by the administration of ether by an anesthetist

The possibility of complicating conditions, such as brain injury, alcoholism and diabetes, should be ruled out

For medicolegal reasons, the usual precautions, including taking samples of blood and urine for toxicologic studies, should be taken

Heavy Metal Intoxication

General measures, such as giving a "universal antidote," performing gastric lavage, instituting catharsis and inducing emesis, will not be considered here

For the treatment of mercury nephrosis, the section on the treatment of acute renal insufficiency should be consulted

BAL (British Anti-Lewisite, Dimercaprol, 2,3-Dimercaptopropanol) Therapy. This therapy is indicated in poisoning from mercury, arsenic and gold. It is of probable value in poisoning due to antimony, bismuth, chromium and nickel. It has no value in silver and lead intoxication. The treatment is as follows:

Severe poisoning (dose is 3 mg. per kilogram of body weight)
- 1st and 2nd days: 1 injection every 4 hours
- 3rd day: 1 injection every six hours
- 4th through 13th day (or until complete recovery): 1 injection every twelve hours

Mild poisoning (dose is 2.5 mg. per kilogram of body weight)
- 1st and 2nd days: 1 injection every four hours for 4 doses
- 3rd day: 1 injection twice daily
- 4th through 13th day (or until complete recovery): 1 injection once or twice daily

Toxic reactions usually disappear in thirty minutes and consist in nausea, vomiting, headache, generalized aching and burning sensation about the head and face. Barbiturates may be used to alleviate these symptoms.

EDTA (Edathamil, Ethylenediamine Tetraacetic Acid, Calcium Disodium Versenate) Therapy for Lead Poisoning. EDTA is a relatively new drug for deleading the bones after the lead has been forced into them by calcium and vitamin D during the acute episode of lead poisoning, or it may be used directly to rid the body of lead.

In the acute phase of poisoning the stomach is lavaged with 1 per cent sodium sulfate solution (when lead has been ingested orally), 30 gm. of the magnesium sulfate solution are left in the stomach before the tube is removed. Demulcents, such as egg white or milk, should be given. Colic is controlled by giving 1.0 gm. of calcium gluconate intravenously and 15 to 30 mg. of morphine sulfate hypodermically as necessary. After amelioration of the acute attack, calcium chloride solution (5 to 20 cc. of 5 per cent solution) is given intravenously at the rate of about 2 cc. per minute. Then 1 to 2 gm. of sodium citrate, 1 to 2 gm. of calcium phosphate and 1 to 2 cc. of vitamin D (USP) are given orally three times daily. In addition, milk should be given in large quantities; 100 mg. of vitamin C may also be given daily with benefit.

For deleading the bones the 1.0-gm. (5.0 cc.) ampule of EDTA is diluted in 250 to 500 cc. of normal saline or 5 per cent dextrose solution and administered over a period of an hour. This amount is given twice daily over a period of up to five days. If necessary, the routine may be repeated after a two-day rest period. Lead displaces the calcium in EDTA, forming a nontoxic compound which is not metabolized and is readily excreted.

Narcotic Poisoning

Nalline Hydrochloride (nalorphine hydrochloride, N-allynormorphine hydrochloride) is an antidote for toxic depression of the respiratory center by morphine and its derivatives, including heroin, Dromoran, Nisentil, Dilaudid, Pantopon and Demerol. It is supplied in 1.0-cc. ampules containing 5.0 mg. of the drug and 2.0-cc. ampules containing 10.0 mg. It is administered intravenously in doses of 5.0 to 10.0 mg. The initial dose may be repeated in ten to fifteen minutes if adequate increase in pulmonary ventilation does not occur. The duration of the action of the drug is from two to three hours. The total dosage depends upon the degree and duration of the depression. Doses as high as 40 mg. have been used. Supportive therapy also should be given.

In obstetrics, Nalline may be given intravenously in a dose of 10 mg. to the narcotized patient ten minutes pre-delivery. The newborn may be given 0.2 mg. intravenously or intramuscularly if it is depressed.

Nalline is not effective against depression due to cyclopropane, barbiturates, or nitrous oxide.

METABOLIC-ENDOCRINE EMERGENCIES

Acute Adrenal Insufficiency

Clinically this should be suspected or anticipated (1) in patients who have had cortisone or ACTH therapy within a few months prior to operation, (2) in patients having operations upon the adrenals without adequate preparation, (3) in patients presenting a clinical picture compatible with anterior pituitary deficiency, or chronic adrenal insufficiency, undergoing surgery, or suffering an intercurrent infection, and (4) in patients with Waterhouse-Friderichsen syndrome—meningococcemia, vascular collapse, severe costovertebral angle tenderness without signs of renal infection, and petechiae.

The following is an outline of the therapeutic plan for the care of patients in severe crisis. For those having milder manifestations, such as patients in the "post corticoid" state subjected to surgery, the same plan is followed, except one-fourth to one half of the dosages are given and desoxycorticosterone administration is frequently omitted.

1. Shock position. Morphine and barbiturates are contraindicated.
2. Intravenously, 1000 cc. of normal saline solution, containing 100 mg. of hydrocortisone, or 100 to 200 cc. of aqueous adrenal cortical extract, are administered in one hour. This treatment is repeated during the second hour, if necessary. However, the second and subsequent infusions should contain 10 per cent dextrose. The total volume of infusions given in one day should not exceed 3000 cc.

This therapy is continued until there is marked improvement or the hematocrit reading is 40 per cent

3 At the onset of treatment, 10 to 25 mg of cortisone or hydrocortisone are given *intramuscularly* in four sites, then 25 to 50 mg are given every six hours (single site) On the second day, 25 mg are given every eight hours On the third day, 12 5 mg are given *orally* every eight hours From the fourth day on, 12 5 mg are given orally every twelve hours

4 If the systolic blood pressure is less than 80 mm Hg, an antishock drug is given, e g, Neosynephrine in 0 3 to 0 5-mg dosage every one to two hours, as required If shock persists, norepinephrine is given with the intravenous fluids and/or plasma

5 Liquids (ginger ale, fruit juice, broth, etc) are given orally after about twelve to twenty-four hours, if nausea and emesis have ceased The diet should be low in fat Parenteral fluids are discontinued when the patient is eating well and his condition appears stable

6 At the point when the patient is given 25 mg of cortisone daily, 1 0 to 2 0 mg of desoxycorticosterone acetate, administered intramuscularly, are added to the regimen The dosage is adjusted for stabilization of weight

7 Antibiotics are given prophylactically, since these patients have poor resistance to infection and an infection frequently will precipitate an attack

8 ACTH is advised for patients in whom atrophy of the adrenal gland still capable of response occurs, e g, in those having recent high-dose corticoid therapy, or the removal of a unilateral cortical tumor Forty units of the gel are given intramuscularly for one to three weeks, followed by a daily 5-unit reduction

The complications are unconscious due to cerebral edema, hypokalemia and hyperpyrexia These are treated as follows

1 In unconsciousness due to cerebral edema, the amount of fluid given intravenously is decreased (especially the sodium chloride), the administration of desoxycorticosterone acetate is discontinued, and the amount of cortisone given is increased If improvement lags, potassium phosphate solution (2 0 gm K_2HPO_4 and 0 4 gm KH_2PO_4 in 1000 cc of 5 per cent dextrose in water) is given The maximum rate of administration is 1000 cc per hour, the maximum amount is 2 liters per twenty-four hours Potassium should not be administered when there is significant impairment of renal function, particularly with oliguria

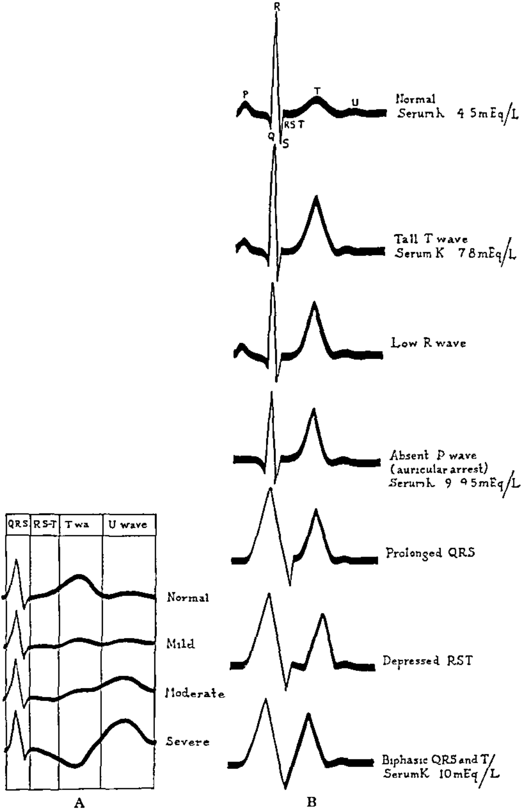

Fig 1 The electrocardiogram in hyperkalemia and hypokalemia

A, In hypokalemia, low serum potassium is associated initially with prolongation of the Q-T interval and lowering and inversion of the T waves RS-T

2 In hypokalemia, manifested by flaccid paralysis, serum potassium less than 3 5 mEq per liter and an electrocardiographic pattern like that shown in Figure 1A, the administration of desoxycorticosterone acetate is omitted and 1 to 8 cc of a 20 per cent solution of potassium citrate are given four times a day In severe cases, the potassium phosphate is given intravenously, as described above

3 In hyperpyrexia, which is to some degree associated with most severe cases and was of more frequent occurrence when desoxycorticosterone was the mainstay in the regimen, the usual treatment consists in giving 0 3 gm of salicylate cautiously at one-half-hour intervals for three doses, or until the temperature falls

Some authorities maintain their patients with Addison's disease on cortisone or hydrocortone alone, and omit desoxycorticosterone from the regimen of the patient in crisis

Diabetic Acidosis-Coma

Diabetic acidosis is an emergency The death rate of its subjects rises with each hour of delay in treatment The mortality should be less than 5 per cent when the acidosis is recent and the carbon dioxide combining power of plasma is above 9 mEq per liter (20 vol per 100 cc) The normal carbon dioxide combining power of plasma is 25 to 30 mEq per liter (45 to 65 vol per 100 cc) When the acidosis has existed for more than a day, with the carbon dioxide combining power less than 9 mEq per liter, the death rate is from 30 to 60 per cent The state of consciousness can be a deceptive criterion of the seriousness of the condition Even with drastic reduction of the carbon dioxide combining power to 6 mEq per liter (13 5 vol per 100 cc) or below, about 10 per cent of the patients are conscious

It should not be assumed that coma in diabetic acidosis is caused solely by the ketosis The coma may be entirely, or in part, due to (1) alcoholic or barbiturate intoxication, (2) cerebral hemorrhage, contusion, or meningitis, or (3) uremia associated with chronic pyelonephritis or renal vascular disease Coma, if the carbon dioxide combining power is 12 mEq per liter (27 mol per cent) or more, is unlikely to be due to ketosis alone

segment depression occurs at about the level of 1 5 mEq per liter (Graph after Surawicz and Lepeschkin Circulation, Vol 8)

B In hyperkalemia high serum potassium causes a tall, peaked T wave when serum potassium is about 7 8 mEq per liter or more Then there occurs a diminution in amplitude of R, and later absence of P At higher levels QRS becomes widened, RS-T depressed, and finally QRS blends with T to give a biphasic curve at level of about 10 mEq per liter

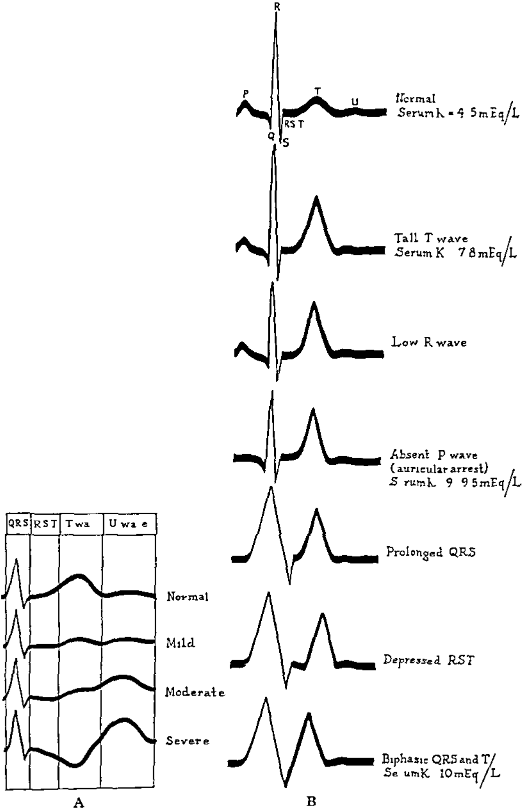

Fig 1 The electrocardiogram in hyperkalemia and hypokalemia

A, In hypokalemia low serum potassium is associated initially with prolongation of the Q T interval and lowering and inversion of the T waves RS-T

therapy, (4) the low serum potassium content is primarily a manifestation of potassium loss during the period of acidosis, and requires treatment whether glucose is given or not The author favors the use of glucose in clear-cut cases, after the second hour, for the body glucose should be adequate for this two-hour period, and because with falling blood sugar there is danger of hypoglycemia Glucose is administered from the start when the diagnosis is doubtful

An outline of the treatment regimen follows

On admission and in the first hour

1 Catheterize bladder and leave indwelling catheter in place (rule out the possibility of bladder rupture)
   a Save, in stoppered container, most of the urine for possible toxicologic examination
   b Test urine for sugar (with Benedict's solution or Clinitest), acetone, albumin, pus, and casts Record sugar as 1+ (green), 2+ (olive), 3+ (orange), 4+ (brick red) Record acetone as 1 to 4+, according to intensity of purple demonstrated in the nitroprusside test or the Ames Acetest tablet test (Note A 1 to 2+ sugar may be found in any patient having severe illness or injury, especially of the brain Acetonuria (1+ to 4+) is common in patients with severe dehydration or starvation from any cause)
2 Lavage stomach with 500 cc of warm tap-water, using a large gastric tube The passage of the tube often induces immediate vomiting, and aspiration and asphyxia may occur To avoid this, elevate the foot of the bed 18 inches, roll the patient to a semi-prone position, and extend the head before introducing the tube Save the gastric contents for possible toxicologic study If the patient is conscious and not retching, instill 500 cc of isotonic saline into the stomach before removing the tube (1 level teaspoonful of table salt in a pint of water) If the patient is unconscious, leave the stomach empty
3 Obtain blood for blood chemistry studies Draw 20 cc of blood Put 10 cc of this in a bottle with lithium oxalate, as an anticoagulant, to be used for determination of glucose, carbon dioxide combining power, chlorides, hematocrit level and nonprotein nitrogen Place the second 10 cc of blood in a clean test tube, allow to stand for thirty to sixty minutes, separate the clot from the tube with a clean glass rod, and remove the serum for determination of serum sodium and potassium If circulatory collapse precludes the use of

The carbon dioxide combining power may be below 12 mEq per liter in uremia, and the nonprotein nitrogen may be from 75 to 100 mg per 100 cc in a dehydrated patient with acidosis One should inquire and examine for precipitating factors in the development of the diabetic acidosis Overeating and omission of insulin in the known diabetic, acute respiratory infections, and pyelonephritis are common precipitating factors and erysipelas, phlebitis and axillary, perineal and ischiorectal infections not unusual ones Acute gastroenteritis with vomiting and diarrhea, acute appendicitis, cholecystitis, and intestinal obstruction may also precipitate diabetic acidosis The acute diseases mentioned may mask or complicate the usual symptoms and signs of diabetic acidosis, which are (1) gradual onset of malaise, weakness, thirst and anorexia, which progress to apathy, lethargy and coma, (2) excessive urination, with vulvar pruritus in women, and balanitis in men, (3) diffuse, dull epigastric pain with vomiting In early diabetic acidosis, the patient's skin is flushed and dry, the lips red, and the breathing deep, rapid and regular With extreme dehydration, the skin is pale and inelastic, the lips dry and slightly cyanosed, the mucous membranes parched, the pulse rapid, and the blood pressure low

The patient is suffering from four serious states (1) peripheral circulatory failure ("shock") from severe dehydration and diminished circulatory blood volume, (2) cerebral depression from the severe ketosis, manifested not only by the coma, but also often by altered deep tendon reflexes and positive Babinski signs, (3) severe depletion of body water and glycogen, and sodium, potassium and chloride (the electrolyte depletion is proportionately greater than the water loss), and (4) the complicating or precipitating illness Surgical procedures should not be performed, even if the indication is urgent, until the acidosis is relieved

There are two schools of thought on whether or not glucose should be administered from the beginning of the therapy Against early administration are the following factors or arguments (1) loss of blood sugar as a guide to the control, (2) hyperglycemia is harmful because of increased fluid and electrolyte loss in the urine, (3) there is enough body fluid glucose to last six hours or more, and (4) glucose intensifies loss of potassium from the body In favor of early administration the following arguments are given (1) the clinical course is an adequate guide to therapy, (2) carbon dioxide combining power, blood ketone determinations,* ketonuria, and acetone on the breath are adequate to follow the course, (3) there is some evidence that body fluid glucose may last only two hours in intensive diabetic coma

* Total ketones in blood Normal, 0 to 5 mg per 100 cc, nondiabetic coma, 5 to 60 mg per 100 cc, diabetic coma, 50 to 200 mg per 100 cc

During second to sixth hours

1 Give insulin, if indicated If the patient's condition fails to improve and heavy glycosuria persists, one-half to all of first hour's total insulin dose may have to be repeated
2 At beginning of the third hour, secure blood for repeat determinations of blood sugar and carbon dioxide combining power For rising blood sugar give *50 to 200 units of insulin, according to* judgment guided by the course and prognosis
3 Give fluids orally as soon as tolerated Give 100–120 cc per hour of tea, coffee, orange juice, ginger ale, broth, or oatmeal gruel, not to exceed 10 gm carbohydrate per hour
4 Watch for signs of low potassium level By the third to eighth hour of saline therapy, the serum potassium may drop to serious levels (1 5 to 3 0 mEq per liter) because of hemodilution, diuresis and return of this ion to the cells Signs of serious hypokalemia are (1) generalized muscular weakness, including the muscles of respiration, (2) falling diastolic blood pressure with bounding pulse, (3) restlessness, confusion and faint voice, and (4) electrocardiographic changes (see Fig 1A) Serious hypokalemia is not a threat in patients who are taking food at this phase of the treatment, as orange juice, skim milk, gruel and broth are rich in potassium
5 Combat persistent shock If, after the first hour, during which 1000 to 2000 cc of saline solution will have been given, the blood pressure is below 100 mm Hg and the urine output has been less than 50 cc, give 500 cc of plasma (or blood if the hematocrit level is low) concurrently with the saline infusion, which is continued If, at the end of the second hour, shock continues, administer norepinephrine (Levophed)
6 Add 5 per cent dextrose to the normal saline solution regimen in the third hour, if the blood sugar is falling

During sixth to twenty-fourth hours

1 Repeat blood sugar and carbon dioxide combining power determinations and give insulin (50 to 200 units) according to clinical judgment if the blood sugar and carbon dioxide combining power levels are not improving If the fall in blood sugar is satisfactory, regular insulin may be given, according to results of the urine tests, every one to four hours, as follows

Reaction	0 blue	1+ green	2+ yellow	3+ orange	4+ red
Dose (regular) (units)	0	5	10	15	20

an arm vein, do a femoral vein puncture (medial to femoral pulse, just below the inguinal ligament) To save valuable time in urgent cases, fluid infusion may be started through the needle used for aspiration of the blood sample

4 Give insulin Administer the initial doses according to the results of blood sugar and carbon dioxide combining power determinations as follows

BLOOD SUGAR	CO_2 C P	INSULIN (CRYSTALLINE [REGULAR])
Up to 300	>12 mEq /l	Up to 50 units
300–600	9 mEq /l or less	100 units
600–1000		300 units
>1000		400 units

In patients in circulatory collapse, give about one-half the selected dose intravenously Be very conservative in patients with diabetes of recent onset and in young children

6 Maintain fluid and electrolyte balance Give 2000 cc of normal saline solution intravenously Repeat this therapy, if indicated by dehydration and circulatory collapse Administer the infusion slowly in older patients

7 Keep the patient warm, but avoid burns

8 Keep a treatment chart, so all data and progress may be easily visualized

HOURS	0	1	2	3	4	5	6	7	8	9	10	11	12
Insulin dose													
Urinary sugar													
Urinary acetone													
Urinary output													
Blood pressure													
Pulse													
I V fluids													
CO_2 coming power													
Blood sugar													
Serum sodium and potassium													
Extra sodium (mEq)													
Extra potassium (mEq)													
Medications													

9 Search for complications Obtain the history to explain the cause of coma Perform a physical examination Especially look for cardinal signs, soft eyeballs, dry tongue, cold mottled skin, impacted rectum

of 210 mEq of sodium without chloride in the first three hours This may be given as

a Sodium bicarbonate—20 gm (4 level teaspoonfuls) in 500 cc of tap water—administered by stomach tube (if there is not over 100 cc of fluid in the stomach)
b Sodium bicarbonate—20 gm (5 to 6 ampules of 3 75 gm each) in 500 cc of distilled water—administered intravenously at the rate of 5 to 10 cc (75 to 150 drops) per minute
c Sodium lactate—1500 cc of 1/6 molar solution—administered intravenously at the rate of 7 to 15 cc per minute (15 cc = 225 drops), as a temporary substitute for isotonic saline solution

2 Potassium ion Do not give potassium until shock is relieved, urinary flow is 50 cc or more per hour, ketosis is improving, and hyperglycemia is lessened Use this therapy if the serum potassium is 3 5 mEq per liter or less and the electrocardiograms show evidence of hypokalemia (see Figure 1A) Potassium is best given by mouth or gastric tube if there is no gastric retention Absorption is rapid and effective within one-half to one hour Potassium may be given in the following forms

a Dibasic potassium phosphate (K_2HPO_4)—5 gm (65 mEq K) (1 level teaspoonful = 6 25 gm) in 100 to 200 cc water—administered by gastric tube every hour for 5 doses
b Dibasic potassium phosphate—5 gm in pint of orange juice or skim milk—administered in 100-cc amounts by mouth or stomach tube every hour for 5 doses One thousand cc of orange juice contain 44 mEq (1 7 gm) of potassium and 0 13 mEq (3 mg) of sodium, 1000 cc of skim milk contain 38 mEq (1 5 gm) of potassium and 23 mEq (0 52 gm) of sodium
c Potassium chloride may be substituted for dibasic potassium phosphate, although the phosphate ion is probably desirable (1 level teaspoonful KCl = 4 3 gm)
d Intravenous potassium Give 3 0 gm of potassium chloride (40 mEq of K) in 1000 cc of 0 45 per cent ("one-half normal") saline solution over a period of two hours (8 cc or 120 drops per minute) The rate should not exceed 20 mEq of K per hour After four hours, if the serum potassium is still 3 5 mEq per liter or less, the intravenous administration of potassium chloride may be repeated once, if the patient cannot tolerate fluids by mouth

Or proceed as described in (2) immediately below

2 The six-hour emergency schedule (Woodyatt) may be employed It may be used if the blood sugar is approaching the normal range and acidosis is not excessive (>12 mEq per liter) In following this regimen, every six hours (e g , 8 A M , 2 P M , 8 P M , and 2 A M), (a) administer a constant glucose supply (e g , given 40 gm , as 800 cc of 5 per cent dextrose, intravenously over about the first one-half of the six-hour period), (b) administer a dose of regular insulin, the size determined by results of the preceding urine test for sugar, or approximately one-quarter of the estimated twenty-four-hour requirement of insulin (in postoperative diabetics the dose would be one-quarter of the twenty-four-hour preoperative requirement), and (c) test urine six hours after each dose of insulin to determine the effect of that dose and to suggest the size of the next If heavy glycosuria persists, increase the dose of insulin by 4 to 10 or more units, if heavy glycosuria is decreased but not eliminated, give the same dose as was previously administered, if glycosuria is eliminated but no hypoglycemic reaction has occurred, reduce the dose slightly, if hypoglycemia occurred, reduce the dose markedly Periodic blood sugar determinations at the beginning of six-hour periods will allow even more accurate estimate of the necessary dose of insulin In older diabetics there may be a high renal threshold On the other hand, in oliguria the blood sugar may give an unfair index of the severity, for with diuresis the blood sugar may drop precipitously

3 Continue to give fluids parenterally until the patient has retained 100–150 cc of fruit juice, broth, or milk taken each hour for four to six hours

During twenty-four to forty-eight hours

1 The patient is discharged to the general medical ward

2 Prescribe a soft diet of about 100–150 gm of carbohydrate, 60 gm of protein, and 50 gm of fat

3 Begin use of NPH, Lente, PZI, or other longer-acting insulins Supplement these with regular insulin

Electrolytes

1 Sodium ion Patients with carbon dioxide combining powers of 15 vol per 100 cc (approx 6 mEq per liter) or less, with severe dehydration, shock, and coma will often benefit from the administration

of 240 mEq of sodium without chloride in the first three hours This may be given as

a. Sodium bicarbonate—20 gm. (4 level teaspoonfuls) in 500 cc. of tap water—administered by stomach tube (if there is not over 100 cc. of fluid in the stomach)
b. Sodium bicarbonate—20 gm. (5 to 6 ampules of 3 75 gm. each) in 500 cc. of distilled water—administered intravenously at the rate of 5 to 10 cc. (75 to 150 drops) per minute.
c. Sodium lactate—1500 cc. of 1 6 molar solution—administered intravenously at the rate of 7 to 15 cc. per minute (15 cc. = 225 drops), as a temporary substitute for iso onic saline solution.

2. Potassium ion. Do not give potassium until shock is relieved, urinary flow is 50 cc. or more per hour, ketosis is improving, and hyperglycemia is lessened. Use this therapy if the serum potassium is 3.5 mEq per liter or less and the electrocardiograms show evidence of hypokalemia (see Figure 1A) Potassium is best given by mouth or gastric tube if there is no gastric retention. Absorption is rapid and effective within one-half to one hour Potassium may be given in the following forms

a. Dibasic potassium phosphate (K_2HPO_4)—5 gm. (65 mEq K) (1 level teaspoonful = 6.25 gm.) in 100 to 200 cc. water—administered by gastric tube every hour for 5 doses
b. Dibasic potassium phosphate—5 gm. in pint of orange juice or skim milk—administered in 100-cc. amounts by mouth or stomach tube every hour for 5 doses One thousand cc. of orange juice contain 44 mEq (1 7 gm.) of potassium and 0 13 mEq (3 mg) of sodium, 1000 cc. of skim milk contain 38 mEq (1.5 gm.) of potassium and 23 mEq (0.52 gm.) of sodium.
c. Potassium chloride may be substituted for dibasic potassium phosphate, although the phosphate ion is probably desirable (1 level teaspoonful KCl = 4.3 gm.)
d. Intravenous potassium. Give 3 0 gm. of potassium chloride (40 mEq of K) in 1000 cc. of 0 45 per cent ("one-half normal") saline solution over a period of two hours (8 cc. or 120 drops per minute) The rate should not exceed 20 mEq of K per hour After four hours, if the serum potassium is still 3.5 mEq per liter or less, the intravenous administration of potassium chloride may be repeated once, if the patient cannot tolerate fluids by mouth.

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insulin dose at the beginning of the first six-hour period is usually one-quarter the total daily insulin required preoperatively

Hypoglycemia

The cause of hypoglycemia should be determined It may be due to exogenous insulin, functional hyperinsulinism, pancreatic adenoma, or pituitary or adrenal insufficiency

Treatment consists in giving 20 to 50 cc of 50 per cent glucose intravenously, slowly Most patients suffering insulin shock will respond promptly unless coma has been prolonged and there has been central nervous system damage

Epinephrine is indicated as a temporary emergency measure in patients with insulin shock if they are well nourished, their liver is not depleted of glycogen, and the reaction is primarily due to a short-acting insulin

Hypoparathyroidism (Tetany)

The causes of hypoparathyroidism are the congenital absence of the parathyroid glands, pseudohypoparathyroidism (failure of tissue response to parathyroid hormone), and surgical damage or destruction of the parathyroid glands Tetany may occur in a number of conditions unrelated to hypoparathyroidism, e g , hyperventilation syndrome, excess alkali ingestion, rickets in the healing phase, and certain cases of uremia We are concerned here primarily with the type associated with accidental surgical damage or loss

Therapy consists in the intravenous administration of calcium gluconate (10 to 20 cc of a 10 per cent solution, given slowly) (this is contraindicated *in the digitalized patient*) and the parenteral administration of parathyroid extract (100 to 300 units, the dose to be repeated in twelve hours, if necessary) Parathyroid extract loses its effectiveness in a few days (? anti-hormone), when this occurs, the oral administration of A T 10 is relied upon Reference should be made to the standard texts for the treatment of the chronic phase The possibility of postoperative bleeding and recurrent laryngeal paralysis (i e , laryngeal stridor of tetany) should be ruled out

Thyroid Crisis (Thyroid Storm, Thyrotoxic Crisis)

A thyroid crisis may occur spontaneously in a patient with hyperthyroidism or it may follow thyroidectomy Its postoperative occurrence is rare in these days of good preparation for surgery with the antithyroid drugs

Equivalence table

	Na^+ (in mEq/l)	K^+ (in mEq/l)	Cl^- (in mEq/l)
Normal serum concentration	135–145	4–5	100–110
Normal' isotonic saline (0 9%)	154		154
1/6 molar sodium lactate	168		
Sodium bicarbonate (1 5%)	180		
Ringer-lactate	130	4	111
Potassium chloride		40	40
Orange juice	0 13	44	
Skim milk	23	38	

1 0 gm KCl (52% K) = 13 3 mEq of K
1 0 gm K_2HPO_4 (45% K) = 11 54 mEq of K
1 0 gm NaCl (39% Na) = 17 mEq Na
1 0 gm $NaHCO_3$ (27 4% Na) = 12 mFq Na

1 level teaspoonful	K_2HPO_4	= 6 25 gm
	KCl	= 4 31 gm
	$NaHCO_3$	= 5 6 gm
	NaCl	= 6 1 gm

Average treatment requirements in adult with serious diabetic acidosis

	1ST 3 HOURS	1ST 24 HOURS
Regular insulin	250–500 units	400–800 units
Isotonic saline (0 9%)	3–4 liters	4–12 liters
'Extra Na	240 mEq	
Potassium	40–80 mEq intravenously, 6 to 12th hrs	
	115–140 mEq orally, 6 to 12th hrs	

In the management of surgical patients, the approach depends upon the severity of the diabetes and the type of the surgical procedure No patient with uncontrolled acidosis should be operated upon

In patients with mild acidosis who are to undergo relatively minor surgery, give one-half of the usual dose of long-acting insulin and supplement this with regular insulin, according to results of the urine test The urine is tested every four hours The regular insulin is usually given subcutaneously, but may be given with the fluids given intravenously Occasionally long-acting insulin is omitted and regular insulin is given with the glucose given intravenously in the dose of approximately 1 unit per 2 gm of glucose Accurate control is not too urgent in the mild case As long as a certain minimum amount of carbohydrate is metabolized, the patient is kept out of acidosis, despite fairly marked hyperglycemia and glycosuria

In patients with severe cases or diabetics undergoing serious major surgery, use the six-hour emergency schedule (Woodyatt) The initial

of glucose per day will be adequate for some patients*), and fat in addition, if oral therapy is feasible In the average patient, 1000 cc of water will be adequate, as this will take care of insensible perspiration loss (at normal environmental temperatures), fecal water loss, and minimal urinary loss, if present. Of course, loss through emesis, suction, fistulae, and excessive perspiration must be compensated for If oral therapy is feasible, 2000 to 25000 calories may be given in form of emulsified vegetable fat and glucose mixtures with flavoring agents If this aggravates nausea, gastric tubal feeding can be tried Hyponatremia and hypochloremia should not be corrected unless severe, as they usually represent redistribution of these ions, rather than total body deficit Similarly, correction of acidosis with sodium lactate or bicarbonate should rarely be attempted, since the defect is primarily one of retained acid and not lost base and such therapy frequently precipitates tetany Anemia should be treated, if the hematocrit level is 30 or below, by giving small transfusions of fresh, packed red cells If there are signs of congestive heart failure, in spite of fluid and electrolyte restriction, the patient should be digitalized slowly Electrocardiograms should be obtained daily, to detect early potassium intoxication (see Fig 1) The electrocardiographic tracing is frequently a better index than the serum potassium value Serious levels of potassium may be brought down by giving ion exchange resins—15 gm of the ammonium or sodium cycle resin by mouth three times daily, or 50 gm in 200 to 300 cc of water by enema twice daily In dire circumstances, a small quantity of a 3 to 5 per cent solution of sodium chloride may be given intravenously, but the effect is transient, its use should be followed by the intravenous administration of 20 to 25 per cent glucose with one unit of insulin added for each 2 gm of glucose (the deposition of glucose as glycogen removes potassium from the circulation) Continuous gastric lavage may be tried, and when facilities are available, peritoneal irrigation, lavage of the large bowel through a cecostomy stoma, or the use of an artificial kidney may be employed It should be noted that orange juice has an extremely high content of potassium, and, since this is commonly given in hospitals, special directions should be given to the nursing staff

The diuretic phase of acute renal insufficiency may begin at any time up to four weeks following the onset With proper treatment, there should be an 80 per cent over-all survival of these patients The nonprotein nitrogen content of the blood may climb during the first few days, despite

* For patients with severe cases it is recommended that 50 per cent glucose in water be infused by polyethylene catheter Optimal utilization occurs at an infusion rate of 0 4 gm per kilogram of body weight per hour

Treatment consists in keeping the patient cool by such means as use of wet towels and fans, giving glucose and sodium iodide intravenously, the administration of oxygen, and heavy sedation In patients with severe cases, 25 mg of cortisone are given orally every four hours, or 100 mg of hydrocortisone in normal saline solution may be administered intravenously

ACUTE RENAL INSUFFICIENCY

The "synonyms" of acute renal insufficiency are shock kidney, transfusion kidney, crush injury, acute tubular necrosis, lower nephron nephrosis, and mercury nephrosis

The etiologic agents or factors include surgical shock, the administration of incompatible blood, accidental intravenous administration of water, "black water fever," pulmonary infarction (massive), drug sensitivity (quinine, Phenurone, the sulfas drugs—either by sensitivity or crystaluria), heavy metal intoxication (mercury, bismuth), and carbon tetrachloride poisoning (ingestion or inhalation, especially with concurrent alcohol ingestion) In most of the patients the renal lesion is reversible in one to three weeks and the object of therapy is to tide the patient over this period

Prophylactic treatment consists in the avoidance of shock and dehydration, caution in use of certain drugs, anticipation of the syndrome in patients having mercury poisoning and the prompt use of BAL, and careful crossmatching of blood

For consideration in the differential diagnosis are obstructive uropathy, acute glomerulonephritis, cortical necrosis in association with eclampsia or abruptio placenta, and embolization of the renal arteries

A favorable outcome depends upon careful study of the fluid-electrolyte balance and rational correction of abnormalities A careful intake-output record must be kept The following should be determined at least every twenty-four hours sodium, potassium, chloride, carbon dioxide and nonprotein nitrogen content of the blood, the hematocrit level, and the serum protein values

Treatment is divided into two phases—the anuric and diuretic

In the anuric phase, diuresis cannot be forced by the administration of excess fluids, in fact, many deaths are related to congestive heart failure precipitated by excess electrolyte-water therapy, usually in the presence of hypertension Daily weight record is an important guide to total fluid requirement Protein catabolism must be diminished by eliminating protein from the diet and omitting protein hydrolysates parenterally Also protein catabolism is spared by providing adequate carbohydrate intake (100 gm

Chapter 21

NURSING CARE IN THE RECOVERY ROOM

ROSE MILONE, R N , MAX S SADOVE, M D , and JAMES H CROSS, M D

RECOVERY ROOM AND THE NURSE

FOR CONVENIENCE in observing and caring for the patient, an air-conditioned recovery room should be a part of the anesthesia and surgical service All patients are admitted to the recovery room immediately postoperatively The unit should be located on the same floor as the operating room and preferably immediately adjacent to it, so that the actual transfer of the patient can be accomplished as quickly and efficiently as possible

The nurse must consider herself to have a necessary and essential part in the care and treatment of the immediate postoperative patient Observation of the patient's condition is a function which often is invaluable to the surgeon and anesthesiologist, and therefore to the patient being treated The attending nurse is constantly observing and caring for the patient properly in order to avoid any serious postoperative complications

The ability of the nurse to evaluate accurately the immediate postoperative condition involves skill and training In addition, the nurse must be constantly aware of the potential dangers immediately following an operation and should make every effort to avoid or prevent unnecessary complications

The beds used in the recovery unit at the University of Illinois Research and Educational Hospitals are Hill-Rom recovery beds and Jarvis stretchers Both types are easily manipulated so that the patient may be placed in the Trendelenburg or Fowler's position without loss of time and effort Both types are equipped with adjustable side rails to prevent the patient from falling Rods may be attached to hold flasks

outputs of 2000 cc or more Large amounts of sodium and chloride may be lost in the early diuretic phase, and this should be detected in serum levels and corrected However, it may merely reflect loss of edema fluid from an underlying condition that would be aggravated by salt and water administration Also, caution must be employed, because the kidney may regain control of the sodium excretion suddenly Occasionally the urine is markedly deficient in sodium and chloride, and the administration of fluid containing these is contraindicated Also, in some patients, potassium is lost massively and replacement is required This is rare if the patient's diet is adequate, which is usually the case at this stage in the management

The immediate postoperative orders are written before the patient is turned over to the recovery room staff

General care of the patient in the recovery room consists of the following routine measures

1 The position of the patient, unless contraindicated, is on his side, with a pillow at his back for support. The knees are flexed so as to provide a minimum amount of strain on any abdominal sutures The face is turned to the side and the chin extended, so that the danger of aspiration will be lessened Pillows approximately 8 by 14 inches have been provided, these are placed underneath the patient's head until he has fully reacted

2 Breathing should be slow, effortless, quiet, deep and regular Obstruction of air passages is evident by change in rhythm or by noisy respiration and cyanosis If an endotracheal tube has been left in place, it should be removed by the anesthesiologist on call

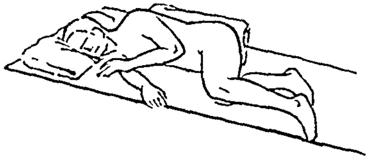

Fig 1 Ideal position of patient

in the recovery room The naso- and oropharynx should be aspirated frequently to maintain a clear air passage If the patient begins to have emesis, his head is turned to one side and the head of the bed is lowered immediately to prevent aspiration

3 Determination of blood pressure and pulse and respiration rates should be made immediately upon the patient's admission to the recovery room, then every fifteen minutes (or more frequently when shock is present) until the patient responds, then every one-half hour until stabilization occurs and then every hour A systolic blood pressure below 90 is reported at once If the patient remains overnight, the blood pressure and pulse and respiration rates are determined every two hours, depending upon the patient's condition, doctor's orders, etc

4 The quality and character of pulse should be noted and recorded Generally a pulse rate above 110 or below 60, or irregularities of the pulse should be reported at once

of intravenous fluids, and the wheels may be locked Beds are sent to the operating rooms according to the needs of the patients The circulating nurse from the operating room sends an attendant for the bed This eliminates unnecessary movement of all patients who are to receive recovery room care

The nursing staff in the postoperative recovery room must have keen powers of observation and excellent judgment, since its members must estimate accurately the patient's condition and know when to call for aid It is preferable that aid be called unnecessarily rather than have the patient suffer unduly

Primarily, all patients are admitted into the recovery room from the operating room A critically ill patient may remain in the ward as long as necessary, depending upon his condition and needs Those who have had extensive or radical surgery remain in the recovery room from one to five days Therefore, the staff nurses of the surgical floors are relieved of the burden of immediate postoperative care, and they are able to perform their routine work more efficiently

Specialized nursing care for the immediate postoperative patient is most essential The nursing staff in the recovery room must be constantly on the alert for any signs or symptoms which may indicate any change (serious or otherwise) in the patient's condition Should a patient require emergency care, each nurse must be capable of caring for this patient and anticipating the physician's orders without loss of time In order to promote efficient nursing care, all types of medications and equipment remain conveniently located in the unit Each nurse should be thoroughly oriented as to the location and use of equipment Duplicate keys for all locked material and supply cupboards must always be available

GENERAL CARE OF PATIENT IN RECOVERY ROOM

In order to promote efficient nursing care, there is provided at each bedside a wall model Baumanometer with blood pressure cuff, oxygen outlets completely assembled (piped-in oxygen), wall-type suction apparatus and a bedside light The permanent type of bed is used if the patient's stay in the recovery room is apt to be of long duration The stretcher type is employed when the stay is likely to be short

The patients are brought into the recovery room with a member of the surgical team and an anesthesiologist in immediate attendance Both of these attendants are required to give verbal report to the nurse before leaving the patient They cannot leave the patient until the hazards are fully understood Immediately, upon the patient's arrival, the attending nurse begins to care for the patient An anesthetized patient is never left alone

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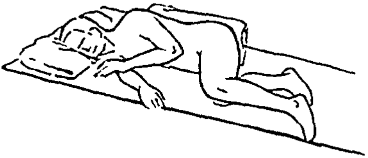

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4 The quality and character of pulse should be noted and recorded Generally a pulse rate above 110 or below 60, or irregularities of the pulse should be reported at once

5 The condition of the skin should be noted, i e, color—good or cyanotic, skin—cold and clammy, or warm and moist These are important signs in diagnosing hemorrhage, oxygen lack and shock

6 All intravenous fluids are checked frequently Drainage tubes, such as gastric tubes, gastrostomy tubes, chest tubes and catheters, are checked and connected to the proper drainage bottles Time and level of fluids must be noted and this record taped to the bottle so that output can be recorded hourly, or as indicated

7 Written postoperative orders are carried out immediately by the attending nurse

8 The temperature must be taken upon admission to recovery ward and every four hours thereafter It is also necessary to take a patient's temperature and determine his pulse and respiration rates immediately after whole blood has been given When unusual changes are occurring these determinations must be repeated more frequently

9 The patient's position should be changed frequently to prevent pulmonary congestion and possible atelectasis As soon as the patient has fully reacted, the head of the bed is elevated slightly, unless this is contraindicated by the type of surgery performed or the anesthetic used Coughing, deep breathing and moving about in bed are encouraged This must be done at least every hour Coughing may be difficult for patients who have had various types of chest surgery, radical neck dissections, certain abdominal procedures and esophagectomies If coughing is not done spontaneously, it should be induced by artificial means Nurses in recovery rooms realize the importance of the above measures and they must assist the patient in order to avoid any serious postoperative complication

10 Patients who have had spinal anesthesia must be observed closely for a decrease in blood pressure Any unnecessary pressure on the legs and toes is avoided Observations are noted and recorded as to the time of complete motor and sensory return Directions must be obtained as to position in bed and duration of this position Unless otherwise specified, the patient should be flat in bed with a small pillow under his head

11 Dysfunction of the bladder may occur after general or spinal anesthesia Spontaneous function is encouraged by all means possible Overdistention of the bladder should be avoided

12 Gastric tubes are irrigated every thirty minutes for the first two

hours, and then every hour, unless contraindicated or other orders have been given by the doctor

13 Accurate measurement and recording of intake and output are done routinely for all patients being treated in the recovery room Intake and output slips are attached to the clip board at the foot of the bed Character and volume of any drainage or output should be observed and recorded

14 Two forceps (with rubber-covered tips) are kept attached to the bed of patients who have intercostal drains (chest tubes) connected to water seal bottles The forceps are to be used in an emergency should the chest bottle break

15 Dressings are checked every one-half hour for any visible staining If staining is present it is reported at once

16 Pain at the site of operation is a common complaint of the patient in the immediate postoperative period The patient's needs are anticipated, however, and any unexplained and persistent ache should be brought to the attention of the doctor

17 All thyroid and radical neck postoperative patients are observed for a possible hematoma which may be developing under the dressing If one is present it is reported at once

18 Oral hygiene measures are taken as soon as possible—preferably, as soon as the patient has become fully awake

19 Continuous check is made to make certain that there is no undue pressure on any part of the body

20 All suction tubes are carefully secured with long pieces of tape to the body and also to the bed by means of safety pin and tape, so that the patient has freedom of action without danger of pulling out the tubes

21 Intravenous infusions are checked regularly for evidence of infiltration, position, rate, etc When possible, the patient's arm is supported so that motion is not limited

RECOVERY ROOM CHARTING

Charting in the recovery room must be accurate, thorough and neatly executed The information on the chart is invaluable to the surgeon and anesthesiologist The attending nurse removes the anesthesia records, temperature graphic sheet and intensive therapy nursing notes from the chart These are attached to the clip board at the foot of the patient's bed for convenience in charting

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3 State of consciousness
4 Presence of drainage or bleeding, etc , on dressings
5 Intravenous fluids started in recovery room
6 Immediate blood pressure, pulse and respiration rates
7 Administration of oxygen
   7 1 Route and method
   7 2 Presence of airways—endotracheal tubes
8 Medications
9 Temperature (state whether rectal or oral)
10 Presence of gastric tubes, chest tubes, catheters, etc
11 Observations, treatments, etc are recorded until the time of discharge
12 Accurate intake and output are recorded until the time of discharge

Discharge from Recovery Room

Patients are not sent to their room or ward without a written anesthesia and surgical release The attendant assigned will return the patient to his room or ward

The patient's chart is prepared properly The x-ray reports, outpatient record, and the like are to be returned The anesthesia record, graphic temperature sheet, and intensive therapy nursing notes are incorporated in the patient's chart The nurse's notes are checked to ascertain that there is a complete record of the patient's stay in the recovery room The condition of patient upon discharge is charted, as well as the time of departure

When the patient is ready to be taken to his room or ward, the head nurse, or the nurse in charge, notifies the nurse in charge of the surgical unit and explains the postoperative orders and the treatments that have been done She also discusses the patient's general condition and any special points about his care

Immediately after patient is discharged from the recovery room an attendant is assigned to clean the unit formerly occupied by him Recovery room equipment is kept clean and in order at all times for the arrival of new patients

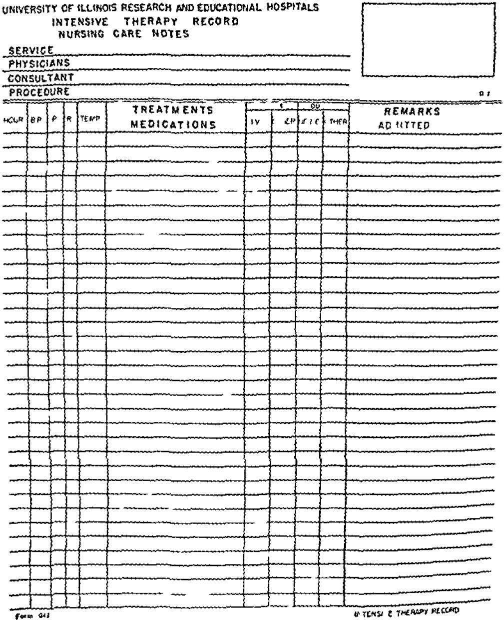
Nurses' Work Sheet

As the patients are admitted to the recovery room, the attending nurse includes any information concerning nursing care on a nurses' work sheet, such as that shown in Figure 3 By this means the nurse in charge gives a thorough and accurate report to the relief nurse

Admission Notes

At admission the following should be charted

1 Time of admission
2 Condition of patient
  2 1 Color of skin
  2 2 Condition of skin
    2 21 Cold and clammy
    2 22 Warm and moist
    2 23 Warm and dry


UNIVERSITY OF ILLINOIS RESEARCH AND EDUCATIONAL HOSPITALS
INTENSIVE THERAPY RECORD
NURSING CARE NOTES

SERVICE
PHYSICIANS
CONSULTANT
PROCEDURE

HOUR	BP	P	R	TEMP	TREATMENTS MEDICATIONS	IV				REMARKS

Fig 2 Intensive therapy record

5 Anesthesiologist
6 Anesthetic
7 Time of arrival
8 Time and date of departure
9 Procedure
10 Therapy (includes oxygen, blood, intravenous fluids)
11 Hospital unit number

Midnight lines are drawn in red ink, also, in red ink, are written the following headings

Total for today
Total for month
Total for year
Complete total

Immediately below the above information are stamped the day and date for a new day in blue or black ink.

MEDICINE CARD

A holder for medicine and treatment cards, upon which are transcripts of doctors' orders, is kept at the nurses' desk Charting of medications and treatments given must not be delayed

A medicine card should be made out for each medication and treatment order as shown below

	FRONT	BACK	
Date	6-1-56	Do not give if pulse below 60	*Special instructions*
Patient's name	Smith, Mr John		
Medicine	Digitalis		
Dose	grains 1 1/2		
Hours	10–6		*Initials of nurse writing card*
	(over)*	RM	

* Denotes further instructions

The following steps are observed in handling medicine cards

1 Write or print neatly
2 Medications or treatments

	7 A M—7 P M	Gray card with black ink
	7 P M—7 A M	In red ink write hours medication or treatment is due

NURSES WORK SHEET

Date__________________ Recovery Ward Room 425

Name and Diagnosis	Hours	Temperature Pulse and Respiration	Diet and Fluid Intake	Medications and Treatments	Condition of Patient and Remarks
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				
	8				
	12				
	4				

Fig 3 Nurses work sheet

Registry Book

All patients admitted to the recovery room are registered in the record book which is kept on the nurses' desk

Headings as follows are written in blue or black ink

1 Patient's name (last name first)
2 Ward assigned
3 Sex
4 Surgeon

Narcotic cabinet with lock
2 desks with chairs (executive type)
2 straight chairs
1 revolving stainless steel stool
Hill Rom recovery beds
Jarvis and Jarvis stretchers
Bedside cabinets
Wall type Baumanometers
Wall type suction outlets
Oxygets (wall type humidifiers)
Lamps with detachable head
Electric suctions (4 to 6)
1 extra tank of oxygen (emergency use)
1 carbon dioxide tank
1 dressing cart
1 anesthesia table
Sanitary waste containers
1 Davis patient roller
1 sphygmomanometer (stand by model)
Curtains (detachable plastic top)
Sterilizer
Electric blanket
Wall clock
Bulletin board
Laundry hampers
Door with vision glass
Telephone
Double electrical outlets
Pneumothorax machine
1 portable bedside table
1 Stanton resuscitator
1 footstool
1 used supply table
Shelves for linen
Step ladder
1 portable traction (orthopedic)
3 wedge shaped foam rubber pillows
24 large pillows
6 small pillows
1 plastic utility compartment for medications

Reference books
- Medical dictionary
- Webster s Dictionary
- Oxygen therapy manual
- Surgical nursing book
- Hospital manuals

EQUIPMENT IN CABINETS

Top Shelf

6—1000 cc Amigen with Levinger
1—1000 cc 3 per cent sodium chloride
6—500 cc dextran in normal saline solution (6%)

3 Do not make card for *stat*, *p r n*, or *narcotic* orders
4 Indicate route of administration, if other than oral, on front of medicine card
5 In red ink, place check and initials after last word of doctor's order before writing out medication and treatment card
Example
Give penicillin, 600,000 units, intramuscularly, b i d R M
Dr Smith
6 Make out treatment card for all patients having a tracheotomy
Example Use card illustrated and write
Remove and clean inner cannula every 4 hours
Indicate hours below
7 Return card to holder after charting medication or treatment

EVENING AND MORNING CARE

All patients remaining overnight will be given evening and morning care

Evening Care

1 Take temperature, determine pulse and respiration rates and blood pressure
2 Wash patient's hands, face and back, and comb hair
3 Oral hygiene
4 Thoroughly examine dressings, drainage tubes, etc
5 Change linen if necessary

Morning Care

1 Take temperature, determine pulse and respiration rates and blood pressure
2 Oral hygiene
3 Complete bed bath
4 Thoroughly examine dressings, drainage tubes, etc
5 Change only soiled lines if patient is to be returned to his room or ward Patients who remain in the recovery room for several days must have linen changed daily and as often as necessary

EQUIPMENT IN RECOVERY ROOM

Air Conditioning
Kitchen
Utility supply room
Sink with work counter and storage space
Storage cabinets (locked) with shelves

Needles

- 40—Gauge 20
- 12—Gauge 18
- 12—Gauge 15
- 10—Gauge 22
- 10—Gauge 23
- 2—Spinal needles

- 1—Scalpel handle with blade
- 3—Levin tubes, size 16
- 2—Levin tubes, size 14

FIFTH SHELF

- Recovery room instrument set
- 12—Cloth restraints
- Foley catheters—2 each
  - Sizes 14, 16, 18, 20, 22, 24
- 2—Catheter syringes
- 2—Foley trays
- 2—Instrument sets
- 1—BLB oronasal mask
- 1—BLB tracheal mask
- 8—Empty bottles (500-cc size)

TBT tray

- Container with endotracheal catheters with and without balloon
- Container with aspirating catheters
- Laryngoscope with handle
- Atomizer
- Intracaine ointment
- 4 masks

SIXTH SHELF

- 1—Tracheotomy set
- 1—Venesection set
  - Vinyl tubing size 18
  - Vinyl tubing size 23
  - Blunt needles
- 1—Pneumothorax set
- 1—Blood transfusion set
- 1—Pelvic examination tray
- 1—Aspirating tray
- 2—Closed chest drainage sets with bottles
- 4—Closed irrigating sets
- 4—Catheter trays, adult
- 12—ABD pads, 12 x 16

UPPER CABINETS

- 1—Urinometer
- 12—Kleenex boxes
- 1 box—Finger cots
- 6—Oral thermometers

2—Abbo-Vac (blood donor bottles)
3—Amigen sets
2—Sterile towel containers
1—Sterile 4 x 4 container
1—Sterile 2 x 2 container
1—Sterile 8 x 10 container
1—Sterile fluff container
1—Sterile applicator-tongue blade container
1—Sterile alcohol sponge container
3—Intravenous sets

Medications

1—Ether
1—Alcohol (70%)
1—Kaolin and pectin
1—Merthiolate
1—Compound tincture of benzoin

Airways (various sizes in glass container)

SECOND SHELF

12—1000 cc Invert 10% in distilled water
9—1000 cc Invert 10% in normal saline solution
6—500 cc stainless steel graduates
6—1000 cc stainless steel graduates
6—Round stainless steel basins
4—Irrigating trays
8—Bulb syringes

THIRD SHELF

1—Narcotic cabinet
1—Narcotic record
1—Insulin syringe
2—Tuberculin syringes
1—Toomey syringe
5—5 cc syringe no 20 needle (tray of 6)
9—1000 cc dextrose in distilled water (5%)
10—250 cc isotonic chloride solution
3—1000 cc dextrose in normal saline solution (5%)
3—1000 cc dextrose in distilled water (10%)
3—1000 cc dextrose in normal saline solution (10%)

FOURTH SHELF

4—Blood forcing bulbs (boxed)
20—Venopak secondary disposable unit
20—Venopak complete disposable unit
20—Secondary blood recipient set
4—Pressure ball valve needle (box of 20)
2—50-cc syringes
15—10-cc syringes
15—20 cc syringes
24—Oxygen catheters (nasal, green)
16—Steritubes

answer their questions to reinforce their confidence in the surgeon and staff Making the patients and the patients' relatives feel as secure as possible by kind and patient attention is the way to minimize anxiety and apprehension

Visitors in the recovery room are allowed if the patient is critically ill At no time should there be more than two visitors in the recovery room since this handicaps the nurse in the care of the patient No visitor should be in the recovery room with a patient who is not fully conscious Brief visits upon recommendation of the surgeon may be granted A short visit, of not more than five or ten minutes, and a limit of one visitor at any particular time are recommended

POSTOPERATIVE NURSING CARE OF CARDIAC PATIENTS

It is generally understood that a patient admitted to the recovery room who has had a general anesthetic is placed, unless contraindicated, on his side with a pillow at his back and a small pillow underneath his head for support The knees should be flexed Turning the face to the side and extending the chin will lessen the danger of aspiration

Breathing should be deep and regular The nasopharynx and oropharynx should be aspirated frequently Obstruction of the air passages is evident by a change in rhythm of the respirations or by noisy respirations and cyanosis If an airway has been left in place, it is not removed by the nurse until the patient has regained his gag reflex Endotracheal tubes are removed by the anesthesiologist on call in the recovery room

As soon as the patient arrives a blood pressure cuff is applied to his arm Blood pressure and pulse and respiration rates are determined immediately upon the patient's arrival and at least every ten or fifteen minutes thereafter until the patient responds, then every one-half hour until they become stabilized, and then every hour

The use of adequately humidified oxygen, routinely ordered to be given by nasal catheter, is administered at the rate of 4 to 10 liters per minute The doctor's orders are read carefully and carried out immediately It is advisable that the attending nurse also read the anesthesia record The record includes information regarding the anesthetic given, the operative procedure, the fluids and medications administered and the patient's general condition

If the patient's body temperature had been lowered to 85° F during the operation, the temperature is taken rectally every five to ten minutes until it is normal Wool blankets or an electric blanket should be available in the recovery room for use if needed to help to elevate the patient's body temperature Thereafter, the temperature and the pulse and respiration

4—Rectal thermometers
12—Lubricant (2-oz size)
6—Gloves, size 8
6—Gloves, size 7 1/2
6—Gloves, size 7
20—Pipe cleaners (pkg of 24)
24—Gauze bandage 2″
Medicine cups, 1-oz paper
Ace bandage 2 , 4″
Elastoplast
Connector tips
- 1/4″ glass, straight
- 3/8″ glass, straight
- 1/4″ glass, Y-shape
- 3/8″ glass, Y-shape

DRAWERS (LEFT)

1st—Medications
2nd—Medications
3rd—Medications
4th—Chemistry bottles
- Acid-washed tubes
- Plain tubes
- Urine specimen bottles
- Clinitest tablets

DRAWERS (RIGHT)

1st—Miscellaneous articles
2nd—Miscellaneous articles
3rd—Emesis basins
4th—Miscellaneous articles

CENTER CABINET (BELOW SINK)

1 gallon—tincture green soap
2 gallon—Zephiran with antirust (1 1000)
2 gallon—Zephiran without antirust (1 1000)
2 gallon—alcohol (70%)
1 gallon—hydrogen peroxide (3%)
1 gallon—alkaline aromatic mouthwash
Paper bags
Bar soap
Soiled gloves in container
1 pair—household gloves

RIGHT CABINET (BELOW SINK)

Adhesive tape (1/2″, 1″, 2″, 3)
Waterproof tape (1″)
Red ink
Blue-black ink
French catheters, unsterile
Rectal tubes, unsterile
Cotton, roll
Rubber tubing, extra
Tourniquets

VISITING IN RECOVERY ROOM

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6—Gloves, size 7
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24—Gauze bandage 2"
Medicine cups, 1-oz paper
Ace bandage 2 , 4
Elastoplast
Connector tips
1/4 glass, straight
3/8" glass, straight
1/4" glass, Y-shape
3/8 glass, Y-shape

DRAWERS (LEFT)

1st—Medications
2nd—Medications
3rd—Medications
4th—Chemistry bottles
Acid-washed tubes
Plain tubes
Urine specimen bottles
Clinitest tablets

DRAWERS (RIGHT)

1st—Miscellaneous articles
2nd—Miscellaneous articles
3rd—Emesis basins
4th—Miscellaneous articles

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2 gallon—Zephiran with antirust (1 1000)
2 gallon—Zephiran without antirust (1 1000)
2 gallon—alcohol (70%)
1 gallon—hydrogen peroxide (3%)
1 gallon—alkaline aromatic mouthwash
Paper bags
Bar soap
Soiled gloves in container
1 pair—household gloves

RIGHT CABINET (BELOW SINK)

Adhesive tape (1/2", 1 , 2 , 3")
Waterproof tape (1)
Red ink
Blue-black ink
French catheters, unsterile
Rectal tubes unsterile
Cotton, roll
Rubber tubing, extra
Tourniquets

VISITING IN RECOVERY ROOM

The nurse should win the confidence of the patient's relatives by giving a careful explanation of the happenings in the recovery room She should

to the bottle The attending nurse should never be far from the patient's bedside, so that she will be able to observe the chest catheter and the water seal drainage frequently

The length of time that cardiac surgical patients remain in the recovery room may vary from twenty-four hours to five days, depending upon the condition and needs of the individual patient If the patient should be required to remain in the recovery room for more than a day, it is necessary that his relatives be allowed visiting privileges A short visit, of not more than five minutes, and a limit of one visitor two or three times a day are recommended Changing pulse, especially increased rate, demands immediate investigation

When the patient is ready to be returned to his room or ward, a release written on the doctor's order sheet by the surgeon and anesthesiologist is required The nurse in charge of the patient in the recovery room calls the nurse in charge of the room or ward to which the patient is to be transferred to notify her and explain the postoperative orders and the treatments which have been executed The recovery room nurse also discusses the patient's general condition and any special points concerning his care

POSTOPERATIVE NURSING CARE OF PATIENTS HAVING RADICAL NECK DISSECTIONS

Following radical neck dissection, the patient is usually semiconscious on arrival from the operating room The surgeon prefers to place the patient in bed with his head elevated at about a 45-degree angle

The attending nurse assumes the responsibility for the care of the patient and receives general information, from the surgeon and anesthesiologist, in reference to special care to be administered and the general condition of the patient

The nursing responsibilities include keeping the airway open, observing the patient's condition, blood pressure, pulse, respirations and temperature, routine tracheotomy care, and administering fluids and medications as ordered

When the patient has a tracheotomy tube in place, the inner cannula is kept open by use of suction applied through a catheter inserted into and through the length of the tube Secretions accumulating in the nasopharynx and oropharynx must be removed by suction because of the patient's inability to expectorate or swallow Coughing is encouraged, and is stimulated, when ordered, by passing the catheter down into the trachea Suction through a catheter is applied as often as necessary The inner tracheotomy tube is removed and cleared with a 3 per cent hydrogen peroxide solution and then rinsed in normal saline solution as often as every one-half to one hour during the first twenty-four hours, and every four hours thereafter for

rates should be determined every four hours and recorded on the temperature graph and in the nurses' notes The condition of the skin should be noted as to the characteristics, and any changes occurring should be reported immediately The temperature, pulse and respiration rates and the condition of the skin are important signs in diagnosing bleeding, low oxygen content of the blood and shock

As soon as the patient has fully reacted and is responding, the head of the bed is elevated slightly, unless this is contraindicated by the type of surgery performed or the anesthetic used Coughing, deep breathing, and movement of legs about in bed are encouraged Frequent observation is made of the dressings covering the operative area for evidences of bleeding or drainage Recognition of early signs of hemorrhage or shock is reported immediately to the doctor

The intravenous administration of fluids started in operating room is continued when the patient arrives in the recovery room The site of an intravenous cannula is examined to see if there are any enlarged, reddened and tender areas, these signs may indicate the onset of an effusion, infection or phlebitis The nurse keeps an accurate record on all fluids administered to the patient by the intravenous and oral routes The surgeon orders the amount of fluid intake he requires for the patient During the first twenty-four postoperative hours, if the patient tolerates fluids orally, water is given in 15-to 30-cc amounts

The output of urine is carefully measured and recorded The nurse reports to the surgeon if there is a decreased amount of urine, in order to help prevent cardiac decompensation Dyspnea, increased respiratory rate, and wheezing and pain on inspiration may be early signs of cardiopulmonary dysfunction Therefore, the nurse in the recovery room must be constantly aware of the patient's condition She reports to the surgeon any immediate change which may occur

In the immediate postoperative period, pain at the site of operation is a common complaint The patient's needs should be anticipated, however, any subjective or objective symptom and persistent pain should be reported to the doctor

During the operation, one or two ribs may have been resected by the surgeon in order to reach the heart A chest catheter will be in place and attached to a bottle Chest (closed water seal) suction is employed to assist in re-expanding the collapsed lung, and in draining accumulated chest secretions, immediately after the operation The bottle is suspended from a bracket under the bed If the fluid level is not constantly fluctuating, this is indicative of obstruction In a short period of time, negative pressure must be indicated by fluid in the tube fluctuating from 2 to 9 cm above the fluid level Time, level and volume must be recorded on the label attached

2 To diminish the work of breathing due to obstruction
3 To protect the skin around the tube and promote healing of the wound
4 To relieve the anxiety of patient

General Information

1 The bottle for drainage must not be over half full at any time
2 A tracheotomy tray always should be available in the unit for use as needed
3 Leakage of food or water through wound should be reported at once
4 An abrasive should not be used in cleaning the cannula The cannula must not be dropped
5 The outer cannula and tape are removed and changed only by doctor
6 The patient should be given oral hygiene frequently
7 Should the outer tracheotomy tube slip out, the trachea is kept open by using a tracheal dilator or hemostat from the tracheotomy tray to enable the patient to breathe until the doctor arrives
8 The patient should be taught to care for himself as soon as possible
9 The dressing (4" x 4") around tube should be changed when soiled
10 The inner cannula should be removed every hour or oftener for the first twenty-four hours, and after that at least once every four hours
11 Medications should not be instilled into the tracheotomy tube unless so ordered by the doctor Aerosol and inhalation therapy adapters should usually be used
12 Suction is applied to the inner cannula every fifteen to thirty minutes, or as necessary Any rales or rhonchi indicate need for suction
13 Each tracheotomized patient receives two tracheal tube sets from the operating room—the one he is wearing and the extra one for re-exchanging purposes On discharge from the hospital, the patient is given the two sets of tubes, these have been charged to their account
14 Extreme care must be taken to avoid cross-infection Catheters must be sterile and changed frequently
15 A writing pad should be kept beside the patient's bed for the purpose of communication
16 Extreme awareness of the psychic effect of this procedure must be part of the management

as long as the patient has a tracheotomy tube in place An emergency tracheotomy set is kept at the patient's bedside at all times, the size of the tracheotomy tube depends upon the surgeon's request

Respiratory obstruction may be caused by improper positioning of the patient, disarranged dressings that cover the tracheotomy opening, or the collection of excessive secretions due to infrequent suctioning or bleeding Any change in the patient's condition is reported to the surgeon immediately The endotracheal tube is removed by the anesthesiologist when the patient has regained his gag reflexes and there is no longer danger of tracheal obstruction, usually after the patient is fully conscious

As soon as the patient's condition permits, the nurse may institute oral hygiene measures Since talking is impossible, the patient is encouraged to communicate by writing The nurse is constantly on guard for any respiratory embarrassment, bleeding, or pain which may occur Caring for the patient gently, tactfully and sympathetically gives him a feeling of security and helps to lessen mental distress

An intake and output are computed accurately and recorded in the nurse's notes Usually, during the first twenty-four or forty-eight postoperative hours, fluids are given by the intravenous route The patient may be given, if so ordered by the surgeon, gradually increasing amounts of water to swallow The nurse should encourage the patient to swallow and teach him to protect his trachea

Short visits, of not more than five minutes' duration, by the patient's relatives two or three times a day, with the limitation of one visitor at a time, are recommended if the patient remains in the recovery room longer than twenty-four hours

When the patient is ready to be returned to his room or ward, a release written on the doctor's order sheet by the surgeon and anesthesiologist is required The nurse in charge of the recovery room notifies the nurse in charge of the section to which the patient is to be transferred and explains the postoperative orders and the treatments that have been done She also discusses the patient's general condition and any special points concerning his care

CARE OF TRACHEOTOMY PATIENT

Objectives

Objectives in the care of the tracheotomy patient are

1 To keep trachea, bronchi and smaller air passages, as well as tracheotomy tube, free of mucus and prevent obstruction of the air passages

2 To diminish the work of breathing due to obstruction
3 To protect the skin around the tube and promote healing of the wound
4 To relieve the anxiety of patient

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2 A tracheotomy tray always should be available in the unit for use as needed
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Care of Catheter

The routine care of all tracheotomy catheters is as follows

1 The aspirating catheter for the tracheotomy opening is to be kept at the patient's bedside in a sterile container filled with normal saline solution when not in use *Label container for catheter Use for tracheotomy opening only*
2 The catheter for nasopharynx and oropharynx aspiration is to be kept at the patient's bedside in a container filled with plain water *Label container for catheter Use for nasopharynx and oropharynx only*

After a catheter has been used the following instructions are carried out.

1 Wash catheter thoroughly and irrigate with tube washer to remove all mucus Sterilize
2 Return to container provided

Charting

On the nurse's record are charted in the hour column, the time, in the treatment column, "tracheotomy care", in the remarks column, "inner cannula cleaned" The character of the mucus and other observations are also recorded

CHEST DRAINAGE (WATER SEAL OR CLOSED DRAINAGE)

In chest surgery, a water seal or closed drainage system is employed The apparatus contains a one-way valve which permits fluid, air, or gases to drain from the chest cavity without letting air in Its purpose is to facilitate drainage of fluid or gases from the pleural cavity in order to prevent tension pneumothorax, and to provide mild negative pressure

General Information

1 There should always be either bubbling in the water or a rising and falling of the water within the glass tube (of at least several centimeters)
2 The end of the long glass tube must always be under water, approximately 1 1/2 inches or slightly more below the water level in the gallon bottle
3 The drainage bottle should be kept *below the level of the patient's chest at all times* The bottle is secured to the bed or floor with special clamps so that it will not be turned over accidentally

Equipment

1 Tracheotomy tray from central supply room (for emergency use)
2 Tracheotomy tube—size and type requested by doctor (extra)
3 Obturator of same size as tracheotomy tube
4 Tracheotomy dressings
5 Pipe-stem cleaners
6 *Suction machine and catheters (whistle tip) (at least 3)*
7 Two small round basins, sterile
8 Hydrogen peroxide (3%)
9 Tissue wipes
10 Paper bag
11 Pencil and paper
12 Mirror
13 *Container with normal saline solution*
14 Container with sterile distilled water
15 Adapters for humidification, aerosol, or inhalation therapy as indicated or needed (most patients require such therapy)

Steps in Cleaning Cannula

1 Explain procedure to patient and reassure him
2 Test suction machine to make certain that the equipment is working
3 Arrange equipment for cleaning cannula, use drainboard or sink
4 Suction inner cannula, unlatch and remove
5 Place inner cannula in basin with hydrogen peroxide Clean inner cannula with pipe cleaners, place under running water to rinse, shake off excessive water
6 Clean exposed part of outer cannula with moistened sponge Suction outer cannula if needed
7 Reinsert inner cannula *Latch guard*
8 Empty solutions as soon as they have been used, clean equipment

Steps in Routine Aspiration of Cannula

Use suction immediately for dyspneic or obstructed breathing, to remove excessive mucus

1 Turn on switch
2 Raise catheter to drain out normal saline solution
3 Pinch catheter and insert into cannula opening 4 to 5 inches (unless ordered otherwise) Withdraw quickly
4 Clear catheter by placing tip in water (Bottle of water is used to clear catheter of mucus, etc) Repeat suction process until airway is clear Leave catheter in bottle of normal saline solution and turn off switch
5 When patient coughs, wipe mucus from opening of cannula and apply suction
6 Change dressing as needed

8 Attach metal top with glass tube
9 Connect tubing to chest catheter
10 Unclamp chest catheter
11 Place a strip of 1/2-inch adhesive tape lengthwise to hold the chest catheter, glass connector tip and rubber tubing securely

After-Care of Equipment

When the catheter is removed by the doctor or the set is changed

1 Flush tubing with clear cold water and wash the outside of the tubing with soap and water
2 Rinse the bottle with cold water
3 Place the complete set in the area provided for used central supply equipment
4 Wash the catheter, if removed, and return it to the operating room

Charting

On the nurse's record are charted in the hour column, the time, in the medication column, "water seal daily care", in the remarks column, the amount and character of the drainage (deduct 500 cc from total content of bottle)

POSTOPERATIVE RECOVERY BED

The postoperative recovery bed should be prepared in such a manner that the patient can be quickly placed in it immediately following his operation It should provide warmth and comfort

Equipment

To prepare the bed for the patient the following are needed

2 sheets (if method 1, described below, is employed) or 3 sheets (if method 2 is used)
1 spread
1 pillow case
1 small quilted pad
1 intake and output slip

General Information

1 Cotton and wool blankets are stored in the linen closet, from whence they may be obtained if needed
2 Weight and pressure of bedding upon the patient's feet or sensitive parts of the body are to be avoided
3 Hot water bottles should not be used to warm the bed or the

4 A rubber-tipped clamp is clamped to the patient's bed sheet near the chest catheter so that it will always be available for emergency use
5 If the bottle is broken or the patient must leave the bed the catheter leading to chest is clamped off
6 The water level and the time the drainage bottle is emptied is noted, so that drainage from the chest can be measured accurately
7 All connections must be securely taped together Tubes must be so arranged that the patient can move freely without any danger of disconnection or leakage

Equipment

1 Closed chest drainage set from central supply room consisting of chest drainage bottle, tubing, glass rods and stopper, chest bottle-carrier, and rubber tipped clamp
2 Safety pins
3 Sterile towel
4 Sterile 1000 cc graduate
5 1000-cc sterile distilled water

Procedure

PREPARATION OF EQUIPMENT To prepare the equipment the following instructions are carried out

1 Put 500 cc, or ordered amount, of sterile distilled water in chest drainage bottle
2 Mark level of water with tape and indicate amount
3 Attach top and rubber tubing to bottle, making certain that the connection is air-tight
4 Attach tubing to chest catheter and unclamp
5 Pin drainage tubing to draw sheet, allowing slack so that the patient may turn

EMPTYING AND MEASURING CONTENTS OF BOTTLE To empty and measure the contents of the drainage bottle

1 Place a sterile towel on the bed near the chest catheter
2 Clamp the chest catheter
3 Remove the metal top with glass tubes from the bottle and lay it on the sterile towel
4 Note the character of the drainage and measure the contents
5 Rinse bottle with sterile distilled water
6 Refill to mark (500 cc) with sterile distilled water
7 Take bottle back to bedside and place on floor

8 Attach metal top with glass tube
9 Connect tubing to chest catheter
10 Unclamp chest catheter
11 Place a strip of 1/2 inch adhesive tape lengthwise to hold the chest catheter, glass connector tip and rubber tubing securely

After-Care of Equipment

When the catheter is removed by the doctor or the set is changed

1 Flush tubing with clear cold water and wash the outside of the tubing with soap and water
2 Rinse the bottle with cold water
3 Place the complete set in the area provided for used central supply equipment
4 Wash the catheter, if removed, and return it to the operating room

Charting

On the nurse's record are charted in the hour column, the time, in the medication column, "water seal daily care", in the remarks column, the amount and character of the drainage (deduct 500 cc from total content of bottle)

POSTOPERATIVE RECOVERY BED

The postoperative recovery bed should be prepared in such a manner that the patient can be quickly placed in it immediately following his operation It should provide warmth and comfort

Equipment

To prepare the bed for the patient the following are needed

2 sheets (if method 1, described below, is employed) or 3 sheets (if method 2 is used)
1 spread
1 pillow case
1 small quilted pad
1 intake and output slip

General Information

1 Cotton and wool blankets are stored in the linen closet, from whence they may be obtained if needed
2 Weight and pressure of bedding upon the patient's feet or sensitive parts of the body are to be avoided
3 Hot water bottles should not be used to warm the bed or the

patient unless specifically ordered, and even then their temperature must never be higher than that which feels warm to the hand

4 Rubber sheeting is employed to protect the entire mattress
5 Undue pressure on any part of body should be avoided
6 The patient should be kept in as comfortable and physiological position as possible

Preparation of Unit and Bed

1 Remove all soiled linen from the unit, place it in the hamper provided
2 Clean the unit with soap and water Wash the inside and outside of the bedside table Wipe all tubing and cord at the bedside with a damp cloth
3 Make bed according to Method 1 or 2 Method 1 is simpler and more practical than Method 2 and is used almost routinely in recovery rooms

Method 1

a Place bottom sheet on bed, tuck in sides, miter corners
b Place top sheet and spread on bed as in open bed
c Arrange as for open bed at top, but in place of tucking in at the foot, fold back neatly in 6-to 8-inch cuff
d Fan-fold top covers from side nearest the door to center of bed

Method 2

a Fold one end of first sheet about 24 inches, place folded end approximately in center of bed, tuck sheet in at foot of bed, miter corners, tuck in at sides
b Fold one end of second sheet as above, place over folded end of first sheet, tuck in at head, miter corners, tuck in at sides
c Place top sheet and spread on bed as in open bed
d Arrange as for open bed at top, but in place of tucking in at the foot, fold back neatly in 6 to 8-inch cuff
e Fan-fold top covers from side nearest the door to center of bed

4 Place quilted pad at head of bed
5 Attach to clipboard at foot of bed an intake and output sheet to be used for the patient

POSITIONS USED IN TREATMENT OF PATIENT

Prone Position

The patient lies on his abdomen, with his face to one side and his legs and arms in line with his body

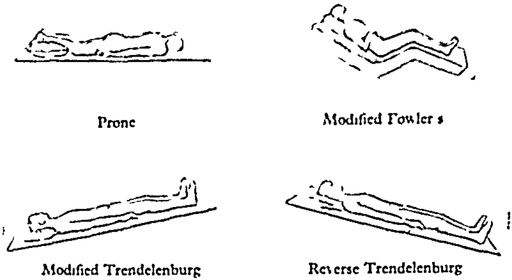

Fig 4 Positions used most frequently in the recovery room

Fowler's Position

The patient sits with his knees flexed moderately In the modified Fowler's position the patient's head and shoulders are raised to about a 45-degree angle

With the Hill-Rom Recovery Bed the patient is placed in Fowler's position by

1 Turning the left crank at the foot of the bed to elevate the head
2 Turning the right crank at the foot of bed to flex the knees moderately

With the Jarvis-Jarvis Cart this position is obtained by

1 Pushing the crank as far as it will go toward the head of the cart, and then turning it to the right to elevate both ends
2 Pulling the crank out and turning it to the left to lower the foot

Trendelenburg Position

The patient is placed on an incline with his head lower than the trunk of his body

With the Hill-Rom Recovery Bed the patient is placed in the Trendelenburg position by

1 Turning the left crank at the foot of the bed to elevate the head slightly

2 Pushing up the metal rod which is directly below the spring at the head of the bed
3 Turning the left crank to lower the head approximately 10 degrees

When the Jarvis-Jarvis Cart is used the crank is pulled all the way out and turned to the right to elevate the foot

OXYGEN INHALATION THERAPY

The primary purpose of oxygen administration is to overcome or prevent a lack of oxygen to the organs and tissues of the patient The recovery room is provided with Oxygets (piped-in oxygen) *Note* The Oxyget humidifier should be turned off when x-ray pictures and electrocardiograms are being taken if the patient is receiving oxygen

Oxygen may be given by the tent technique, through oxygen masks, or through nasal catheters

An oxygen tent is seldom used in the recovery room When one is required it is secured from the anesthesia department

Oxygen masks are employed when high concentrations of oxygen are required The mask must be well-fitted about the patient's face Positive pressure, tracheal masks and BLB masks of various types are obtained from the anesthesia department

Administration through a nasal catheter is a simple method of giving Oxygen It allows the nurse to care for the patient without interruption It is used routinely when oxygen therapy is required in the recovery room, unless the doctor's orders are written to the contrary Such therapy is given upon request of the doctor and on the requirement of the patient at the discretion of the nurse, if a doctor is not available Nasal catheters are obtained from the anesthesia department

NASAL CATHETER FOR OXYGEN ADMINISTRATION

Equipment

4 x 4 gauze or Kleenex
Humidifier with tubing
Nasal catheter (green)
Lubricant
Adhesive (1/2 inch)
Flashlight
Tongue blade

Procedure

1 Put sterile distilled water in bottle—fill to one-half mark
2 Connect nasal catheter to humidifier and turn on humidifier to number of liters of oxygen per minute requested by doctor

3 Lubricate catheter, taking care that the lubricant does not plug the end of the catheter
4 Measure the catheter from the nose to the earlobe, marking the distance with your thumb
5 Insert the lubricated catheter through the patient's nostril, previously selected, very gently
6 Tape the catheter in place securely at the nose
7 Request the patient to open his mouth and inspect the pharynx *The tip of the catheter should be just out of sight behind the soft palate*

Nasal catheters must be changed daily or frequently enough to be kept clean and patent at all times They should be washed thoroughly with soap and water before being returned to the anesthesia department

CARBON DIOXIDE THERAPY

Carbon dioxide, or carbonic acid gas, is the product of combustion of carbon with a free supply of air Therapy with this gas is given to stimulate respiration

General Information

1 Carbon dioxide is used in the recovery room to stimulate the respiration of breathing patients and *not for resuscitation*
2 Carbon dioxide is administered by the nurse only on the request of the anesthesiologist or surgeon, and only after the nurse has been trained in its use
3 A carbon dioxide cylinder is located in the recovery or utility-supply room This and rubber tubing comprise the equipment
4 High concentrations should be administered only by persons trained in the use of carbon dioxide
5 Carbon dioxide is heavier than air
6 The gas is pure carbon dioxide, it should be administered carefully
7 To replace the empty carbon dioxide cylinder the anesthesia department should be called

Procedure

Do not use mask or cone

1 Turn on the cylinder valve gently
2 Hold the tube so as to permit a gentle flow of gas 6 or 8 inches from the patient's face
3 Encourage the patient to breathe deeply, usually five or six whiffs

2 Pushing up the metal rod which is directly below the spring at the head of the bed
3 Turning the left crank to lower the head approximately 10 degrees

When the Jarvis-Jarvis Cart is used the crank is pulled all the way out and turned to the right to elevate the foot

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4 x 4 gauze or Kleenex
Humidifier with tubing
Nasal catheter (green)
Lubricant
Adhesive (1/2 inch)
Flashlight
Tongue blade

Procedure

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3 Encourage the patient to breathe deeply, usually five or six whiffs

are given until respiration becomes faster and/or deeper Stop the administration if the patient does not respond after six inhalations

4 Take the pulse during the treatment If there is an increase of more than 15 pulsations per minute, or if the pulse becomes weaker or irregular, discontinue the treatment and notify the physician in charge Also, discontinue the treatment if dyspnea becomes severe
5 Turn off the cylinder with the regulator handle and make certain that there is no leakage of carbon dioxide
6 Replace the cylinder where it will not be knocked over

Charting

On the nurse's record are charted *in the hour column, the time,* in the medication column, "CO_2 inhalation", in the remarks column, the type of response noted after the treatment

EXTUBATION OF AIRWAYS AND ENDOTRACHEAL TUBES

Airways

Airways may be removed by the nurse when the patient's reflexes have sufficiently returned to permit breathing without danger of obstruction from the patient's tongue, as usually demonstrated by coughing, swallowing, or gagging

Following use, airways are cleaned by soaking them in a liquid soap solution They are then rinsed well, sterilized and returned to their container

Endotracheal Tubes

Preferably these tubes are removed by the anesthesiologist concerned or the doctor on call In the event the doctor is not immediately available and if the patient is very intolerant of the endotracheal tube to the point where he objects to its presence, the tube may be gently and slowly removed according to the following technique

1 The mouth and pharynx must be very thoroughly aspirated of mucus or other material present
2 A thorough tracheobronchial toilet must be performed at least twice according to the approved technique
3 The cuff, if inflated, may then and *only* then be deflated
4 Reinsert the aspirating catheter to its full extent and then remove the endotracheal tube with the catheter inserted, thus cleaning the proximal portion of the trachea

Following use the endotracheal tube is washed with soap and water, irrigated with a tube washer, soaked in alcohol (70 per cent) for thirty minutes and returned to its container

USE OF ASPIRATOR (WALL-TYPE, BUILT-IN)

The upper respiratory tract, nasopharynx and oropharynx are cleared of excess bloody and mucous secretions by means of introducing a catheter and applying suction

General Information

1 Correct use of suction and the proper positioning of the patient are important in maintaining a free airway
2 Interrupt the suction by clasping the catheter before inserting the tip in the patient's nasopharynx or oropharynx Suction should begin upon release of the catheter If these steps are omitted, the catheter sucks against the mucous membranes of the nose and mouth while it is being inserted, causing trauma and edema
3 The ends of catheter must not be sharp
4 Empty the bottle containing the material aspirated when the bottle becomes one-half full
5 Use separate catheters for nasopharynx and oropharynx aspirations Label the containers

Equipment

Wall-type aspirator with drainage bottle and tubing
Whistle-tip rubber catheter
Metal tip
Solution containers

Procedure

1 Assemble the necessary equipment at the patient's bedside Fill the solution bottles with plain cold water Turn the handle on the wall to start the suction Test the equipment
2 To aspirate, clasp the catheter and insert it into the nasopharynx or oropharynx cavity and then release it
3 Withdraw the catheter and clear it by placing the tip in water
4 Repeat the procedure as often as necessary
5 To empty the drainage material, turn the suction off, unscrew the bottle from the fixed metal top and empty the contents of the bottle in the hopper, making note of the amount and character of the secretions Rinse the bottle in cold water and screw it in place

are given until respiration becomes faster and/or deeper Stop the administration if the patient does not respond after six inhalations

4 Take the pulse during the treatment If there is an increase of more than 15 pulsations per minute, or if the pulse becomes weaker or irregular, discontinue the treatment and notify the physician in charge Also, discontinue the treatment if dyspnea becomes severe
5 Turn off the cylinder with the regulator handle and make certain that there is no leakage of carbon dioxide
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Charting

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Equipment

1 Cart with mattress covered with sheet
2 Cotton blankets for surgical patients as needed
3 Pillows as needed
4 Charts, x-rays, and equipment as ordered
5 Canvas lifter

Technique

All persons taking part in transferring patients from the cart to the bed or from the bed to the cart must be *ready* to lift at the same time

There should be one attendant to lift the patient's head and shoulders, one to lift his feet, and two—one at either side—who use the canvas lifter or blanket which was previously placed underneath the patient

In some instances, depending upon his condition or other factors, patients may be able to move themselves onto the cart with very little assistance

GENERAL INFORMATION

1 Recovery room location The unit is staffed twenty-four hours a day
2 Outside visitors are not allowed in the recovery room at any time This does not include the patient's relatives
3 If a patient is on the critically ill list, members of the immediate family will be permitted, with permission from the doctor, to see the patient for a few minutes at a time
4 No smoking will be permitted in the recovery room at any time by the patients or personnel
5 The recovery room will not be left without a nurse or attendant while any patient is unconscious or disoriented
6 Isolation patients are placed in a bed nearest the door—the operating room entrance into the recovery room
7 The recovery room is provided with wall suctions and Oxygets When not in use these should be turned off
8 All admissions are recorded in the recovery registry book
9 An anesthesiologist is available twenty-four hours a day
10 The beds for all patients who have had chest surgery performed are brought to the operating room, as are those for heavy patients and patients difficult to handle A nurse from the operating room sends for the beds
11 Patients who have had spinal anesthesia do not leave the recovery room unless their blood pressure, pulse and respirations are stable

After-Care of Equipment

1 Empty and wash the drainage bottle
2 Wipe the tubing with a damp cloth
3 Wash the solution containers and the catheters and sterilize them

Charting

On nurse's record are charted in the hour column, the time, in the medication and treatment column, "aspiration of oropharynx" (or nasopharynx), in the remarks column, the approximate amount and the character of the drainage

TRANSPORTING THE PATIENT FROM THE RECOVERY ROOM

On his release from the recovery room the patient is transported to his assigned room or ward in an operating room cart He must be removed from the recovery room bed to the cart and from the cart to his bed with the least possible delay and exposure, in order to prevent pulmonary complications and postoperative shock

General Information

1 A canvas lifter placed under the patient's hips or a blanket previously placed full length underneath the patient promotes more efficient handling as well as greater comfort to the patient
2 No attempt should be made to move the patient unless sufficient help is available The number of persons needed for lifting depends upon the site of operation, the type of surgery performed, the weight of the patient, the location of drainage and intravenous tubes, and similar factors
3 The patient must be moved gently His head is held firmly with his lower jaw upward, in order to maintain full air passages and to prevent the patient from swallowing his tongue The patient's head is turned to the side if emesis occurs or if mucus or blood is present in his mouth
4 The site of operation must be kept in mind Increased strain on sutures, drains and intravenous tubing is unnecessary It should be made certain that all intravenous tubing, drainage tubes, and the like remain in working order during the transfer of all patients
5 The patient is placed in the proper position in bed or the position ordered by the physician in charge upon his arrival at his room or ward
6 The patient's chart, x-rays, and the like are kept under the mattress at the foot of the cart during transit

Equipment

1 Cart with mattress covered with sheet
2 Cotton blankets for surgical patients as needed
3 Pillows as needed
4 Charts, x-rays, and equipment as ordered
5 Canvas lifter

Technique

All persons taking part in transferring patients from the cart to the bed or from the bed to the cart must be *ready* to lift at the same time

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nurse Always record the amount of fluid given orally on the intake and output sheet

13 When moving a patient from his bed to a cart or changing a patient's position, see that drainage tubes and dressings are not disturbed

14 Emesis basin, Kleenex and a hand towel must be placed on the cart when the patient is transferred Without fail, notify the nurse in charge of the room or ward of the patient's return before leaving the area

15 Clean and sterilize all urinals and bedpans after each use

16 Give oral hygiene to patients when necessary Morning care is given by the night nurse and night nurse's aide

17 Check bedside tables when reporting on duty

18 Clean cabinets in recovery room once a week Clean glass-door cabinets and base cabinets in utility work room once a week

NURSES' AIDES' ASSIGNMENTS

Daily Assignments

1 Daily ward order in recovery room

2 Bedside tables to contain two boxes Celluwipes, two turkish towels, two hand towels, two wash cloths, soap dish with bar of soap, and toilet tissue

3 Immediately after a patient has been returned to his room or ward, clean unit

4 Keep all tubing on suction bottles, Oxygets, etc , put away neatly when not in use

5 Fold blood pressure cuffs neatly when not in use

6 Clean dressing cart daily and resupply

7 Clean ink-wells and top of desks in recovery room as needed

8 Return and obtain sterile supplies from central supply room each morning

9 Restock intravenous fluids in cabinet

10 Clean electric Gomco suctions thoroughly after each use (4 Gomco suctions are to remain in recovery room)

11 Keep kitchen and utility room in order

12 Oxyget humidifiers (glass jars) are to contain sterile distilled water

13 Check linen supply closet

14 Keep recovery room supplies in order and ready for use

15 Check carbon dioxide and oxygen tank and have ready for use

Weekly Assignments

1 Replace soiled blood pressure cuffs with clean ones

2 Irrigate wall suction tubing with soap solution
3 Clean interior and exterior of sterilizer Change sterile distilled water in reservoir as often as necessary
4 Wash shelves in kitchen and utility room
5 Defrost and clean interior and exterior of refrigerator
6 Wash and sterilize. (1) lifting forceps and forceps containers, (2) alcohol sponge container and (3) small 2 x 2-inch container Refill forceps containers with Zephiran solution (1 1000) with antirust.

Monthly Assignments

1 Put up all new supplies which have been delivered from general storage room.
2 Replace soiled curtains with clean ones Wash upper portion of curtains (plastic) with soap and water
3 Wash wheels on Hill-Rom Recovery Beds, Jarvis and Jarvis Carts and dressing cart, with soap and water
4 Clean medicine and supply cabinets, wash shelves

CRITICALLY ILL PATIENTS

1 A critical-ill form is made out by the doctor and incorporated in the patient's chart
2 The resident or head nurse is responsible for notifying the nearest relatives as soon as the patient is placed on the critical list
3 The nurse in charge is responsible for notifying the information desk and the nursing office, and for taking care of requests for religious services For all Catholic patients, the neighborhood priest is called so that the last Sacrament may be administered The various church affiliations of the patients are listed in the nursing office

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